ENERGY ENGINEERING ANALYSIS PROGRAM

AT

FORT LEAVENWORTH, KANSAS

FINAL SUBMITTAL

ENERGY SURVEY BUILDING 111 - BELL HALL EXECUTIVE SUMMARY

CONTRACT NUMBER DACA41-86-C-0061

JUNE 4, 1990



KANSAS CITY DISTRICT CORPS OF ENGINEERS

METRIEUTION STATERIMIT A

Approved for public release Distribusion Undimited

DEPARTMENT OF THE ARMY

CONSTRUCTION ENGINEERING RESEARCH LABORATORIES, CORPS OF ENGINEERS P.O. BOX 9005 CHAMPAIGN, ILLINOIS 61826-9005

REPL ##O ATTENTION OF:

TR-I Library

17 Sep 1997

Based on SOW, these Energy Studies are unclassified/unlimited. Distribution A. Approved for public release.

Marie Wakef eld,

Librarian Engineering

Introduction:

Bell Hall (Building No. 111) at Ft. Leavenworth, constructed in 1957, has undergone one major addition completed in 1986. Bell Hall is primarily used for officer training, which was its original intent. Over the years, equipment loads within the facility have increased, mainly due to increased computer usage. The original construction of this facility did not anticipate the additional computer load and the present mechanical and electrical systems are undersized. The systems are not capable of providing cooling all year; which is a requirement for the new computers. Since it's implementation, the HVAC systems have had problems maintaining environmental control. Saving energy and improving environmental control at the same time for this facility will be a difficult task. Many of the systems don't maintain the minimum temperature and ventilation levels in the building and are shut down most of the time. Modifying these systems to use less energy will require construction modifications to allow proper operation. This increased the cost of the ECO's and made reasonable paybacks difficult to achieve.

Scope:

Under Base Contract No. DACA41-86-C-0061, an energy audit and engineering study Bell Hall Building No. 111 was performed. The scope included the following:

- A. Measure supply, exhaust and return air volumes for each air supply system in the building.
- B. Review and observe HVAC system controls.
- C. Perform a field audit of facility's lighting levels, miscellaneous equipment loads and occupant quantities.
- Verify lighting and occupant schedules through field observation and personal interview.
- E. Provide adequate documentation of field investigation

Introduction Page 1

many and the same of the sale of the sale

notes.

- F. Develop a computer simulation of the buildings base energy consumption using daily and hourly simulation procedures.
- G. Determine possible methods of energy conservation and simulate energy conservation methods using an hourly computer simulation program, and compare results to the base line model.
- H. Determine probable construction costs for each energy conservation method and perform a life cycle cost analysis of the project using the information gathered.

Note: The electrical / lighting portion of this project was performed and the ECO's have already been implemented under another contract.

Work Accomplished:

The field survey on Bell Hall at Ft. Leavenworth was started in September of 1986. It included measuring 29 air supply systems, counting all facility lighting, measuring miscellaneous electrical loads, recording zone temperatures, measuring exhaust volumes, measuring boiler combustion efficiency, measuring chillers operating parameters, counting occupants, observing typical facility operation and interviewing occupants and operating personnel. All data collected through this investigation was then entered into a computer database for manipulation.

From the field data, building plans, and previous energy studies we simulated the facility's energy consumption on the PCDOE computer program. Once the base energy consumption of the facility was developed we made additional computer simulation runs for each Energy Conservation Opportunity (ECO). We then determined energy savings and prepared preliminary probable construction cost estimates for each of the ECO's. The savings investment ratio (SIR) was computed

Introduction Page 2

for each ECO. ECO description data, probable construction cost, energy savings and economic analysis are included in Volume I, Section II of this submittal. All computer simulation results are included in Volume II of this submittal.

Building Data

The facility's HVAC system consists of 5 multizone air supply systems, 24 unit ventilators, 1 built up VAV system, 2 packaged single zone DX systems, 6 packaged thru the wall air conditioners, 13 single zone heating and cooling supply systems, 3 make-up air ventilation systems and 240 two-pipe fan coil units. The unit ventilators, multizone air supply systems, built-up VAV system and 2 of the constant volume air supply systems have economizer capability. The fan coil units are two-pipe with one coil which is used for both heating and cooling. The Classrooms, Eisenhower Auditorium and Marshall Auditorium have perimeter radiation systems for perimeter heating. These systems are only active when the boiler is operating.

The central heating/cooling plant consist of 3 boilers, 2 chillers, 1 cooling tower and 14 base mounted pumps. Since piping arrangement is a 2-pipe system, the central plant is either providing heating or cooling but is not capable of providing simultaneous heating and cooling. Reference figures No. 1 and 2 for the flow schematics of the heating and cooling at Bell Hall.

Classrooms (Original Facility):

The unit ventilators serve the classrooms in the original part of the facility. They provide ventilation and economizer air in the winter and provide cooling and ventilation air in the summer. The units are manually switched from summer to winter operations by a summer/winter switch located in the boiler room of Bell Hall. In the winter, the economizers on the unit ventilators are activated to allow for winter cooling. The economizer does not look at the room temperature to see if cooling is

Introduction Page 3

required. Therefore, if no cooling air is required, the air is reheated to room temperature by the unit ventilator coil which wastes energy. This control sequence was analyzed in detail under ECO-M7.

Office Wing:

The office wing in the original facility is served from the two-pipe fan coil system for heating and cooling. Ventilation air is provided by a roof-top air handling unit (RTU-3) and is intended to operate all year. However, RTU-3 is out of service and is not allowed to operate in cold temperature due to coil freeze-up. Inspection so this unit indicates that it is badly damaged and needs to be replaced. In addition, unit's pipe insulation is damaged from previous repairs.

Facility Maintenance:

Presently the facility has one maintenance engineer on temporary assignment from 7:30 a.m. to 4:30 p.m. Prior to the installation of the building automation system Bell Hall had three, full time maintenance engineers. These positions were eliminated. None of the air systems in Bell Hall have clean usable filters. Some of the air systems did not even have filters. Based on the condition of air filters and other items requiring periodic maintenance, we recommend the post consider increasing the maintenance operations staff assigned to the building.

Introduction Page 4

BELL HALL BUILDING 111

EXISTING ANNUAL ENERGY CONSUMPTION

ELECTRICITY					
KWH	DOLLARS	MBTU			
8,725,854	\$461,611	29,781			

NATURAL GAS							
THERMS	DOLLARS	MBTU					
2.78E-07	\$87,550	27,794					

TOTA	L
DOLLARS	MBTU
\$549.160	57,575

ENERGY CONSERVATION ANALYSIS

ALL ECOs INVESTIGATED - BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS	ENERGY SAVINGS	CONSTRUCTION	TOTAL PROJECT	SIMPLE	SIR
		MBTU/YR	(\$)	COST	COST*	YEARS	
-ATING	VENTILATION AND AIR CONDITION	NING					
	Convert existing multi-zone						
M1	air handling units to VAV	6015.0	\$34,842	\$320,775	\$352,853	10.1	1.
	Convert office and classrooms to		*** ***	#0.40F.040	#0.04F.407	00.6	^
M2	4-pipe system with VAV	13983.0	\$63,500	\$3,495,843	\$3,845,427	60.6	0.
	Convert existing 2-pipe system	7448.0	\$30,800	\$1,720,729	\$1,892,802	61.5	0
<u>M3</u>	to 4-pipe Modified Class Room ventilators	7446.0	\$30,000	\$1,720,729	\$1,032,002	01.5	- 0
M4	outdoor air control sequence	21405.0	\$107,363	\$77,873	\$85,660	0.8	14.
1014	Condenser water temperature	21400.0	Ψ107,000	Ψίζιοι	400,000		
M5	reset	219.0	\$3,395	\$14,621	\$16,083	4.7	1.
1010	Provide fan shoutdown during	2.0.0	75,555	1 1 1 2 2			
M6	night and off peak hours	6573.0	\$42,178	\$32,168	\$35,385	0.8	12
M7	Boiler Oxygen Trim Control						
M8	Provide new heat recovery chiller	3302.0	\$9,600	\$2,150,586	\$2,365,645	246.4	0
	Convert to primary/secondary						
M9	pumping system	2274.0	\$38,680	\$314,356	\$345,792	8.9	1
M10	Reduce cooling tower fan power	186.0	\$2,883	\$22,359	\$24,595	8.5	1
IILDING	G ENVELOPE						
A1	Install Double Pane Windows	343.0	\$1,600	\$51,461	\$56,607	35.4	C
					i		
A2	New roof (existing building)	1399.0	\$8,600	\$135,508	\$149,059	17.3	0
	Reduce qty of dock doors			****	405 545	00.0	_
A3	and provide dock seals	271.0	\$1,100	\$32,313	\$35,545	32.3	0
A4	Reduce Solar Load with solar films	1942.0	\$16,788	\$144,891	\$159,380	9.5	1
A5	Air Curtains	340.0	\$1,330	\$18,472	\$20,319	15.3	1
.,,	Wall Insulation w/ reduction		T .1.				
A6	in window area (option a)	1541.0	\$16,800	\$1,517,272	\$1,668,999	99.3	
	Wall Insulation w/ reduction						
A6	in window area (option b)	1541.0	\$16,800	\$552,000	\$607,200	36.1	(

ENERGY CONSERVATION ANALYSIS

ECOs RECOMMENDED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR	
HEATING	EATING VENTILATION AND AIR CONDITIONING							
M1	Convert existing multi-zone air handling units to VAV	6015.0	\$34,842	\$320,775	\$352,853	10.1	1.09	
M4	Modified Class Room ventilators outdoor air control sequence	21405.0	\$107,363	\$77,873	\$85,660	0.8	14.40	
M5	Condenser water temperature reset	219.0	\$3,395	\$14,621	\$16,083	4.7	1.93	
M6	Provide fan shoutdown during night and off peak hours	6573.0	\$42,178	\$32,168	\$35,385	0.8	12.79	
M9	Convert to primary/secondary pumping system	2274.0	\$38,680	\$314,356	\$345,792	8.9	1.01	
M10	Reduce cooling tower fan power	186.0	\$2,883	\$22,359	\$24,595	8.5	1.07	
BUILDING	G ENVELOPE							
A4	Reduce Solar Load with solar films	1942.0	\$16,788	\$144,891	\$159,380	9.5	1.43	
A 5	Air Curtains	340.0	\$1,330	\$18,472	\$20,319	15.3	1.21	

ENERGY CONSERVATION ANALYSIS

ECOs REJECTED -- BELL HALL BLDG 111

ECO	DESCRIPTION	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS (\$)	CONSTRUCTION COST	TOTAL PROJECT COST*	SIMPLE PAYBACK YEARS	SIR		
HEATING	EATING VENTILATION AND AIR CONDITIONING								
M2	Convert office and classrooms to 4-pipe system with VAV	13983.0	\$63,500	\$3,495,843	\$3,845,427	60.6	0.19		
МЗ	Convert existing 2-pipe system to 4-pipe	7448.0	\$30,800	\$1,720,729	\$1,892,802	61.5	0.19		
M7	Boiler Oxygen Trim Control								
M8	Provide new heat recovery chiller	3302.0	\$9,600	\$2,150,586	\$2,365,645	246.4	0.05		
BUILDING	G ENVELOPE	T							
A1	Install Double Pane Windows	343.0	\$1,600	\$51,461	\$56,607	35.4	0.47		
A2	New roof (existing building)	1399.0	\$8,600	\$135,508	\$149,059	17.3	0.86		
АЗ	Reduce qty of dock doors and provide dock seals	271.0	\$1,100	\$32,313	\$35,545	32.3	0.55		
A 6	Wall Insulation w/ reduction in window area (option a)	1541.0	\$16,800	\$1,517,272	\$1,668,999	99.3	0.13		
A6	Wall Insulation w/ reduction in window area (option b)	1541.0	\$16,800	\$552,000	\$607,200	36.1	0.35		

ENERGY CONSERVATION ANALYSIS Bell Hall

Non-ECIP Projects

HOH-LOH HOJCOLS						
PROJECT GROUP		ENERGY	ENERGY	PROJECT	SIMPLE	
BELL HALL BLDG 111	EΦ	SAVINGS	SAVINGS	COST	PAYBACK	SIR
		MBTU/YR	\$	\$	YRS	
GROUP 1						
Modify O.A. Controls			:			
Class Room Ventilators	ECO-M4	21405.0	\$107,363	\$85,660	0.8	14.56
Condenser Water Temp Rese	ECO-M5	219.0	\$3,395	\$16,083	4.7	1.93
Modulate Cooling Tower Fans	ECO-M10	186.0	\$2,883	\$24,595	8.5	1.07
Fan Shutdown - Night	ECO-M6	6573.0	\$42,178	\$35,385	0.8	12.79
Į			·	-		
GROUP 1 TOTALS		28383.0	\$155,819	\$161,723	1.0	10.78
			ŕ	-		

GROUP 2						
Install Solar Film	ECO-A4	1942.0	\$16,788	\$159,380	9.5	1.43
Air Curtains at Dock Doors	ECO-A5	340.0	\$1,330	\$20,319	15.3	1.21
GROUP 2 TOTALS		2282.0	\$18,118	\$179,699	9.9	1.03

ECIP Projects

GROUP 3						
Convert Multi-Zone AHU to Variable Air Volume	ECO-M1	6015.0	\$34,842	\$352,853	10.1	1.09
Convert to Primary Secondary System	ECO-M9	2274.0	\$38,680	\$345,792	8.9	1.01
GROUP 3 TOTALS		8289.0	\$73,522	\$698,645	9.5	1.05

BELL HALL BUILDING 111

ENERGY AND COST SAVINGS

TOTAL POTENTIAL ENERGY AND COST SAVINGS

	ENERGY	ENERGY
	SAVINGS	SAVINGS
	MBTU/YR	\$/YR
GROUP 1	28,383	\$155,819
GROUP 2	2,282	\$18,118
GROUP 3	8,289	\$72,522
TOTAL	38 954	\$246.450

PERCENTAGE OF ENERGY CONSERVED

POTENTIAL ENERGY SAVINGS, MBTU	38,954
EXISTING ENERGY CONSUMPTION, MBTU	57,575
PERCENT ENERGY CONSERVED	67.7%

ENERGY USE AND COST

	ENERGY	ENERGY
	MBTU/YR	\$/YR
BEFORE ECO IMPLEMENTATION	57,575	\$549,160
AFTER ECO IMPLEMENTATION	18,621	\$302,701

ENERGY CONSERVATION ANALYSIS Bell Hall

Non-ECIP Projects

HOII LOIL TIOICOIS						
PROJECT GROUP		ENERGY	ENERGY	PROJECT	SIMPLE	
BELL HALL BLDG 111	ECO	SAVINGS	SAVINGS	COST	PAYBACK	SIR
		MBTU/YR	\$	\$	YRS	
GROUP 1						
Modify O.A. Controls						
Class Room Ventilators	ECO-M4	21405.0	\$107,363	\$85,660	0.8	14.56
Condenser Water Temp Rese	ECO-M5	219.0	\$3,395	\$16,083	4.7	1.93
Modulate Cooling Tower Fans	ECO-M10	186.0	\$2,883	\$24,595	8.5	1.07
						40.70
Fan Shutdown - Night	ECO-M6	6573.0	\$42,178	\$35,385	0.8	12.79
						10.70
GROUP 1 TOTALS		28383.0	\$155,819	\$161,723	1.0	10.78

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M4

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M4) analyzes the energy savings that may be realized by modifying the ventilation air handling unit controls. The modifications will allow for the proper operation of the existing economizer system.

SCOPE:

This E.C.O. simulation (ECO-M4) will modify the controls to the existing classroom ventilation units to permit an effective economizer control operation. The modifications will include control modifications and a change in the sequence of operation for each unit ventilator. The control modifications will modulate the outside air and return air dampers during the cooler seasons of the year, based on the outside air temperature and the room air temperature conditions. The control valve(s) for the heating coil(s) will remain inoperative or closed unless the outside air conditions are below freezing. The control valve will be cracked open only when the outside air temperature drops below a determined set-point to prevent coil freezing. The room heating requirements will be satisfied by the existing fin tube radiation system.

Reference Figure No. 1. Modifications to the existing unit ventilators will require new temperature sensors, sequencing relays, and controllers to operate the face and bypass dampers and to operate the outside air and return air dampers. The existing dampers, damper motors, and room thermostats will remain as installed except for minor calibrations.

MODELING TECHNIQUES:

The changes made to our base model for this simulation inlude the following:

ECO-M4 PAGE 1

Classroom unit ventilators were changed from the modified VAVS
 (re: Modeling Techniques, Section I) system to single zone
 heating and cooling system (SZRH).

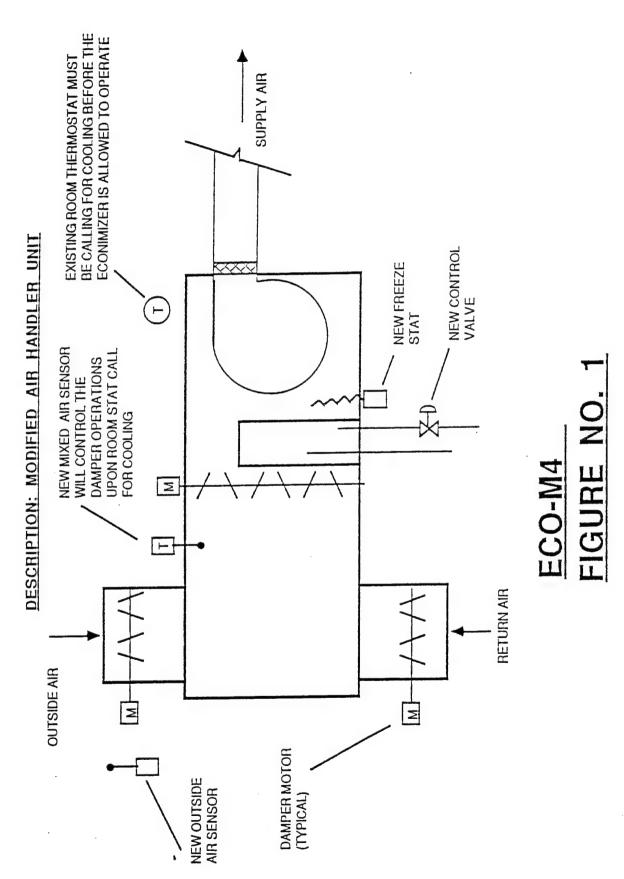
SUMMARY:

The probable project cost is \$85,700. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M4) are approximately 21,400 MBTU per year and \$110,400 per year.

The simple payback for this simulation is 0.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 14.56.



Page 3

CONSTRUCTION COST ESTIMA	TE		DATE PREF			SHEET (ĢF
PROJECT				16-Feb-87		1	2
PROJECT BELL HALL ENERGY STUDY				BASIS FOR E	SIMAIE		
LOCATION		×			(COMPLETED)		
FORT LEAVENWORTH, KANSA	s					(PRELIMINA	
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKU	D			ļ		(FINAL DESI (SPECIFY)	GN)
DECRIPTION DECRIPTION	<u>' </u>	ESTIM	ATOR	<u> </u>	OTTLA	CHECKED B	Y
				J.B.			G.S.
CUMMARY. FOO MA		ALLA	LABO			ATERIAL	TOTAL
SUMMARY: ECO-M4	NO.	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST
DEMOLITION WORK TOTAL:				\$0		\$0	\$0
NEW WORK TOTAL:				\$38,500		\$12,500	\$51,000
SUBTOTAL:				\$38,500		\$12,500	\$51,000
CONTINGENCY			10.00%	\$3,850	10.00%	\$1,250	\$5,100
SUBTOTAL				\$42,350		\$13,750	\$56,100
COMP., TAX. SOC. SEC., INS.			13.50%	\$5,717	3.50%	\$481	\$6,199
SUBTOTAL				\$48,067		\$14,231	\$62,299
OVERHEAD AND PROFIT			25.00%	\$12,017	25.00%	\$3,558	\$15,575
CONSTRUCTION COSTS:							\$77,873
						1	
79574 70 70 70 70 70 70 70 70 70 70 70 70 70							
		·					

CONSTRUCTION COST ESTIMATE			DATE PREPARED			SHEET OF		
				16-Feb-87			2 2	
PROJECT		BASIS FOR 8	STIMATE					
BELL HALL ENERGY STUDY								
LOCATION		X	CODE	(NO DESIG	N COMPLETED)			
FORT LEAVENWORTH, KANSA	\$				CODE	PRELIMINA	ARY DESIGN)	
ARCHITECT/ENGINEER					CODEC	(FINAL DES	IGN)	
CLARK, RICHARDSON & BISKU DECRIPTION	Ρ	TECTIV	ATOR	<u> </u>	OTHER	(SPECIFY)	200	
		ESTIM	ATOR	J.B.		CHECKED	G.S.	
ECO-M4 (CLASS ROOMS)	T OUA	NTITY	LAB		1 14/	ATERIAL	TOTAL	
(SUMMARY)	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST	
(COMMACT)		MEAS.		TOTAL	UNIT	IOIAL	0001	
DEMOLITION:	1 011110	11112710	0.111	-	0.111		+	
NONE				\$0		so	so	
CONSTRUCTION:	 							
VENTILATION UNIT CONTROL MOD.	24	EA	\$1,500.00	\$36,000	\$500.00	\$12,000	\$48,000	
MOBILIZATION	1	LS	\$2,500.00	\$2,500	\$500.00	\$500	\$3,000	
			!					
				į į			1	
	-							
							Ì	
							ļ	
							1	
					1			
		İ	İ	1	1			
				ł				
	-							
			į	ŀ				
		ł	i	i	-			
		1						
			T				1	
		1	1					
		1	1					
		1	ļ	1				
		ł		1		-		

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: FTLVBDLM LCCID 1.001

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT LEAVENWORTH

REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM4

ANALYSIS DATE: 05-31-89 **ECONOMIC LIFE 15 YEARS** PREPARED BY: CRB

1.	INV	E5	IM	IFN I	

•	1147 CO 1141 C.111		
	A. CONSTRUCTION COST	\$	77873.
	B. SIOH	\$	7787.
	C. DESIGN COST	\$	3894.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	80599.
	E. SALVAGE VALUE COST	-\$	0.
	F TOTAL INVESTMENT (1D-1E)	\$	80599

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL		JNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED AVINGS(5)
A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$ \$	15.50 .00 .00 3.15 .00	3234. 0. 0. 18170. 0.	\$ \$ \$ \$ \$	50127. 0. 0. 57236. 0.	8.59 11.28 12.01 12.76 10.17	430591. 0. 0. 730325. 0.
F. TOTAL			21404.	\$	107363.		\$ 1160916.

NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4)

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$ 383102.
A IF 3D1 IS = OR > 3C GO TO ITEM 4	
D 15 -5 : 10 - 44 - 41 - 41 - 41 - 41 - 41 - 41 -	

B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= C IF 3D1B IS = > 1 GO TO ITEM 4

D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) 107363.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) 1160916.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5/1F)=14.40 (IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M5

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M5) analyzes the energy savings that may be realized by allowing the chiller condenser water temperature to be controlled during low ambient wet bulb conditions.

SCOPE:

This E.C.O. simulation (ECO-M5) modifies the existing boiler room condenser piping loop. The modifications will allow the control of the condenser water temperature for optimum chiller operation. The construction work will include new pipe installation, existing pipe modifications, and control modifications.

Reference Figure No. 1 for the boiler room equipment layout and pipe modifications.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- 1. The minimum condenser water temperature shown on line 2,340 (re: Volume II, Section I) was changed from 85° F. to 65° F.
- 2. The tower water temperature control was changed from "FIXED" to "FLOAT" on line 2,344.

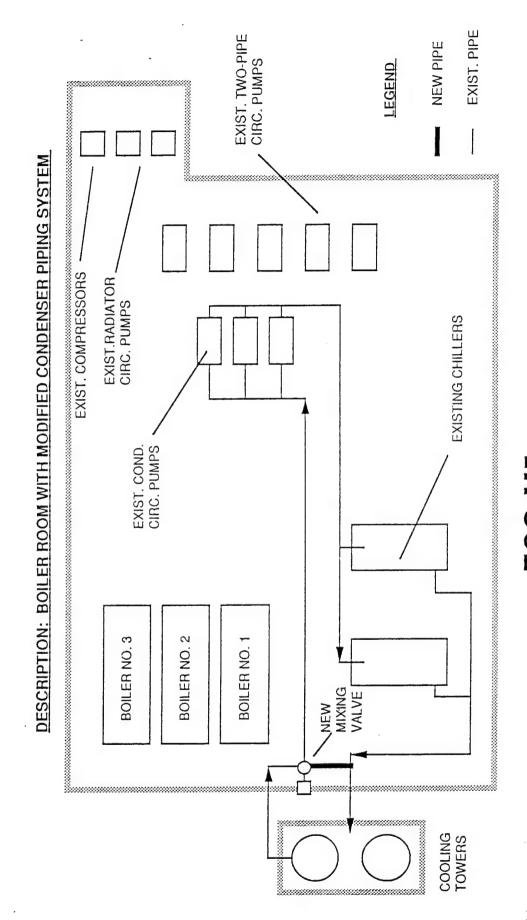
SUMMARY:

The probable project cost is \$14,650. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M5) are approximately 220 MBTU per year and \$3,400 per year.

The simple payback for this simulation is 4.3 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.93.



ECO-M5 FIGURE NO. 1

CONSTRUCTION COST ESTIMATE			DATE PREP			SHEET	OF 2
200 1507				16-Feb-87 BASIS FOR E	STIMATE	1	
PROJECT BELL HALL ENERGY STUDY				DASIS FOR E	STIVIATE		
LOCATION				×	CODE A (NO DESIGN	COMPLETED
FORT LEAVENWORTH, KANSAS					CODE B (PRELIMINA	RY DESIGN)
ARCHITECT/ENGINEER				<u> </u>	OTHER (S	FINAL DESI	GN)
CLARK, RICHARDSON & BISKUP DECRIPTION		ESTIM	ATOR	L	OTHER IS	CHECKED	BY
DEGRIF HOR				J.B.			G.S.
		NTITY		BOR		TOTAL	TOTAL COST
SUMMARY: ECO-M5	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	0031
DEMOLITION WORK TOTAL:				\$0		so	\$0
NEW WORK TOTAL:				\$6,004		\$3,690	\$9,694
SUBTOTAL:				\$6.004		\$3,690	\$9,694
CONTINGENCY			10.00%	\$600	10.00%	\$369	\$969
SUBTOTAL				\$6,604		\$4.059	\$10,663
COMP., TAX. SOC. SEC., INS.			13.50%	\$892	3.50%	\$142	\$1,034
SUBTOTAL				\$7,496		\$4,201	\$11,697
OVERHEAD AND PROFIT			25.00%	\$1.874	25.00%	\$1,050	\$2,924
TOTAL PROJECT COSTS:							\$14,621
			·				
	}		1	i]		

ENG. FORM 150

CONSTRUCTION COST ESTIMATE		DATE PREPARED			SHEET OF 2 2		
PPO ISCT			<u> </u>	16-Feb-87 BASIS FOR E		2	
PROJECT BELL HALL ENERGY STUDY				BAGIOT GITE			
LOCATION				×	CODE A	NO DESIGN	COMPLETED
FORT LEAVENWORTH, KANSAS			CODE B	PRELIMINA	RY DESIGN)		
ARCHITECT/ENGINEER					OTHER (S	FINAL DESI	GN)
CLARK, RICHARDSON & BISKUP DECRIPTION		ESTIM	ATOR	٠	OTHER IS	CHECKED	BY
ECO-M5 (BOILER ROOM)		2311101	ATON	J.B.		O LEONED	G.S.
EGG-ING (BOILE)! NO GW)	QUA	NTITY	LA	BOR	MAT	TERIAL	TOTAL
(SUMMARY)	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST
	UNITS	MEAS.	UNIT	ļ	UNIT		
DEMOLITION:				\$0		\$0	\$0
NONE CONSTRUCTION:	0			30		30	30
TEMP. GAUGES	4	EA	\$7.00	\$28	\$50.00	\$200	\$228
Telm : G/GGEG							
PRESS. GAUGES	4	EA	\$6.50	\$26	\$15.00	\$60	\$86
CONTROL MODIFICATIONS	1	LS	\$3,200.00	\$3,200	\$2,600.00	\$2,600	\$5,800
MOBILIZATION	1	LS	\$2,750.00	\$2,750	\$830.00	\$830	\$3,580
							•
	1 1	i	- 1	1	1	į	

LIFE CYCLE COST ANALYSIS SUMMARY

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001

INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOMS ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

7	TATE TO COLUMN TO	
1 .	INVESTMENT	

A. CONSTRUCTION COST	\$	14621.
B. SIOH	\$	1462.
C. DESIGN COST	\$	731.
D. ENERGY CREDIT CALC (1A+1B+1C) X.9	\$	15133.
E. SALVAGE VALUE COST	-\$	0.
F. TOTAL INVESTMENT (1D-1E)	S	15133

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL		UNIT COST \$/MBTU(1)		SAVINGS MBTU/YR(2)	TUAL \$ VINGS(3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)	
A.	ELECT	\$	15.50	219.	\$ 3395.	8.59		29159.
B.	DIST	\$.00	0.	\$ 0.	11.28		0.
c.	RESID	\$.00	0.	\$ 0.	12.01		0.
D.	NAT G	\$	3.15	0.	\$ 0.	12.76		0.
E.	COAL	\$.00	0.	\$ 0.	10.17		0.
F.	TOTAL			219.	\$ 3395.		\$	29159.

3. NON ENERGY SAVINGS(+) / COST(-)

A.	ANNUAL RECURRING (+/-)		\$ 0.
	(1) DISCOUNT FACTOR (TABLE A)	9.11	
	(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.

- C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$
- D. PROJECT NON ENERGY QUALIFICATION TEST
 - (1) 25% MAX NON ENERGY CALC (2F5 X .33)

A IF 3D1 IS = OR > 3C GO TO ITEM 4

B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=

C IF 3D1B IS = > 1 GO TO ITEM 4

D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

- 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 3395.
- 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 29159.
- 6. DISCOUNTED SAVINGS RATIO (SIR) = (5 / 1F) = 1.93(IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M10

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M10) analyzes the energy savings that may be realized by allowing the cooling tower fans to operate with variable speed controllers.

SCOPE:

This E.C.O. simulation (ECO-M10) installs cooling tower fan variable speed controllers. The modification will require installation of the variable speed controller units in the existing boiler room and the electrical modifications to accommodate the controller installation. The construction work will include modifications to the Building Automation System software to monitor and control the variable speed controller unit.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

 PC-DOE command "TWO-SPEED=TOWER-FAN-CONTROL" was inserted at Line No. 2,346 (re: Volume II, Section I)

SUMMARY:

The probable project cost is \$24,595. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M10) are approximately 200 MBTU per year and \$2,900 per year.

The simple payback for this simulation is 7.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.07.

CONSTRUCTION COST ESTIMATE			DATE PREF			SHEET	OF
			<u> </u>	16-Feb-87		1	2
PROJECT				BASIS FOR ES	SIMALE		
BELL HALL ENERGY STUDY LOCATION				×	CODE A	NO DESIGN	COMPLETED
FORT LEAVENWORTH, KANSAS					CODE B	PRELIMINAF	RY DESIGN)
ARCHITECT/ENGINEER					CODE C	FINAL DESIG	an)
CLARK, RICHARDSON & BISKUP					OTHER (SPECIFY)	
DECRIPTION		ESTIM	ATOR			CHECKED	
	OUA	NTITY	1 1 1	J.B. BOR	MA	TERIAL	G.S.
SUMMARY: ECO-M10	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST
SOMMATI. ECO-MIO		MEAS.		101712	UNIT	1011.2	
DEMOLITION WORK TOTAL:				\$450		\$0	\$450
						20.550	244224
NEW WORK TOTAL:				\$6,075	<u> </u>	\$8,556	\$14,631
SUBTOTAL				\$6,525		\$8,556	\$15,081
GERTOTAL				00,020			
CONTINGENCY			10.00%	\$653	10.00%	\$856	\$1.508
				4		20.444	*10.500
SUBTOTAL	-			\$7,178		\$9,411	\$16,589
COMP., TAX. SOC. SEC., INS.			13.50%	\$969	3.50%	\$329	\$1,298
TAX. 300. 320., 110.			10.0070	\$333			
SUBTOTAL				\$8,146		\$9,740	\$17,887
OVERLIE AND SPORT	1		25.00%	\$2,037	25.00%	\$2,435	\$4,472
OVERHEAD AND PROFIT		-	25.00%	32,037	25.0076	32,400	34.472
							444 454
CONSTRUCTION COSTS:							\$22,359
	 						

CONSTRUCTION COST ESTIMATI		DATE PREF		SHEET OF 2 2			
PROJECT			1	16-Feb-87 BASIS FOR ES		4	
BELL HALL ENERGY STUDY				. ,	2005.4	NO DESIGN	COMOLETED
LOCATION FORT LEAVENWORTH, KANSAS		X	CODE A	(NO DESIGN (PRELIMINAF	COMPLETED RY DESIGN)		
ARCHITECT/ENGINEER				CODE C	(FINAL DESIG	GN)	
CARK, RICHARDSON & BISKUP		Icoru.	ATOD		OTHER (SPECIFY) CHECKED E	
DRAWING NO. ECO-M10 (BOILER)	ESTIM	ATOH	J.B.		CHECKED	G.S.	
	QUA	NTITY		BOR		TERIAL	TOTAL
(SUMMARY)	NO. UNITS	UNIT	PER	TOTAL	PER	TOTAL	COST
DEMOLITION:	UNITS	IMEAS.	UNIT		UNIT		
DISCONNECT EXISTING ELEC. SERVICE	1	LS	\$450.00	\$450		\$0	\$450
CONSTRUCTION:	1.	LS	\$1,750.00	\$1,750	\$6,225.00	\$6,225	\$7,975
PROVIDE/INSTALL SPEED CONTROLLER	1	LS	\$1,750.00	31,750	36,223.00	30,223	37,973
ELEC. RECONNECT .	1	LS	\$125.00	\$125	\$350.00	\$350	\$475
CONTROLS FOR CONTROLLER	1	LS	\$925.00	\$925	\$1,350.00	\$1,350	\$2,275
SYSTEM TEST AND BALANCE	1	LS	\$1,950.00	\$1,950	\$280.50	\$281	\$2,231
MOBILITZATION	1	LS.	\$1,325.00	\$1,325	\$350.00	\$350	\$1,675
	-						
	-						
	ļ						
			"				
					-		
					-		
:							

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.00 INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM10
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

Α.	CONSTRUCTION COST	\$	22359.
в.	SIOH	\$	2236.
c.	DESIGN COST	\$	1118.
D.	ENERGY CREDIT CALC (1A+1B+1C) X.9	\$	23142.
E.	SALVAGE VALUE COST	-\$	0.
F.	TOTAL INVESTMENT (1D-1E)	\$	23142.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	EL	-	HIT COST MBTU(1)	SAVINGS MBTU/YR(2)	TUAL \$ VINGS (3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
Α.	ELECT	\$	15.50	186.	\$ 2883.	8.59	24765.
B.	DIST	\$.00	0.	\$ 0.	11.28	0.
C.	RESID	\$.00	0.	\$ 0.	12.01	0.
D.	NAT G	\$	3.15	0.	\$ 0.	12.76	0.
E.	COAL	\$.00	0.	\$ 0.	10.17	0.
F.	TOTAL			186.	\$ 2883.		\$ 24765.

3. NON ENERGY SAVINGS(+) / COST(-)

- A. ANNUAL RECURRING (+/-) \$ 0. (1) DISCOUNT FACTOR (TABLE A) 9.11 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 0.
- C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0
- D. PROJECT NON ENERGY QUALIFICATION TEST
 - (1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 8172.

A IF 3D1 IS = OR > 3C GO TO ITEM 4

B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=

C IF 3D1B IS = > 1 GO TO ITEM 4

D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

- 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 2883.
- 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 24765.
- 6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.07 (IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M6

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-M6) analyzes the energy savings that may be realized by turning off air handling units and mechanical equipment during the unoccupied periods of the day.

SCOPE:

This E.C.O. simulation (ECO-M6) will use the existing Building Automation Energy System to turn off existing mechanical equipment and air handling units during the unoccupied periods of the day. The equipment in this simulation includes the following:

- 1. Ventilation units in the class room areas
- Ventilation units in the office areas of the general building and Johnson Wing
- 3. Ventilation units in the library and Marshall areas
- 4. Mechanical pumps for the chilled water and heating systems
- 5. Chiller units and associated tower fans and condenser pumps

This work may be accomplished by using the existing building automation system. The existing automation system presently has the capability to monitor and operate the existing mechanical equipment. To accomplish the shut down and start-up characteristics of this simulation, modifications to the building automation system software would be required. The installation of additional control sensors and components to accomplish this simulation will be minimal

compared to the overall project cost of upgrading the existing building automation system.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- 1. Schedules named "FAN" and "FAN2" (Re: Volume I, Section I) on lines 1,612 and 1,614 were changed from continuous operation to a computer control operation. The fan schedules changed for the fans would de-energize at 10:00 p.m. and restart at 5:00 a.m. on weekdays and de-energize at 6:00 p.m. and restart at 6:00 a.m. on weekends and holidays.
- 2. Set fan cycling to allow fans to cycle on to maintain a minimum of 55 ° F. (AR -1127) during unoccupied periods.

SUMMARY:

The probable project cost is \$35,385. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-M6) are approximately 6,600 MBTU per year and \$43,000 per year.

The simple payback for this simulation is 0.7 years.

The savings to investment ratio (S.I.R.) for this simulation is 12.79.

CONSTRUCTION COST ESTIMATE			DATE PREP			3	OF
PPO IECT				16-Feb-87 BASIS FOR E		1	22
PROJECT BELL HALL ENERGY STUDY				שייייייייייייייייייייייייייייייייייייי			
LOCATION		-		X		(NO DESIGN	
FORT LEAVENWORTH, KANSAS						(PRELIMINAF	
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKUP					OTHER	(SPECIFY)	•
DECRIPTION		ESTIM	ATOR			CHECKED BY	
	T 0114	NTITY	1.4	J.B. BOR	M	I ATERIAL	G.S. TOTAL
SUMMARY: ECO-M6	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST
SUMMART: EGG-MG		MEAS.	UNIT	, , , , ,	UNIT		
DEMOLITION WORK TOTAL:				\$0		\$0	\$0
NEW WORK TOTAL:				\$8,430		\$13,360	\$21,790
SUBTOTAL				\$8,430		\$13,360	\$21,790
CONTINGENCY			10.00%	\$843	10.00%	\$1,336	\$2,179
SUBTOTAL				\$9,273		\$14,695	\$23.968
COMP., TAX SOC. SEC., INS.			13.50%	\$1,252	3.50%	\$514	\$1,766
SUBTOTAL				\$10,525		\$15,210	\$25,735
OVERHEAD AND PROFIT			25.00%	\$2,631	25.00%	\$3,802	\$6,434
CONSTRUCTION COSTS:							\$32,168
				•			

CONSTRUCTION COST ESTIMATE	DATE PREF	PARED		OF			
				16-Feb-87	7	2	22
PROJECT				BASIS FOR	ESTIMATE		
BELL HALL ENERGY STUDY							
LOCATION	X	_ CODE A	(NO DESIGN	COMPLETED			
FORT LEAVENWORTH, KANSAS ARCHITECT/ENGINEER		- CODE B	(PRELIMINAR	TY DESIGN)			
CLARK, RICHARDSON & BISKUP		_ CODE C	(FINAL DESIGNATION (SPECIFY)	JIN)			
DECRIPTION	ATOR		OTHER	CHECKED B	/		
ECO-M6		LOT IIV	ATOR	J.B.		O I LOKED B	G.S.
	QUA	YTITA	LA	BOR	M	ATERIAL	TOTAL
(SUMMARY)	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST
		MEAS.		<u> </u>	UNIT		
DEMOLITION:						1	
NONE	ļ	<u> </u>		\$0		\$0	\$0
CONSTRUCTION:							
CONTROL MOD. TO AUTOMATION SYSTEM	1	LS	\$7,930.00	\$7,930	\$13,200	\$13,200	\$21,130
MODULIZATION	۱ .		2500.00	0500	2400.00	04.00	2000
MOBILIZATION	1	LS	\$500.00	\$500	\$160.00	\$160	\$660
	İ						
	1						
	 			†	 		
					ļ		
	1						
		!					
							
			*				
		1					
		ĺ					İ
		- 1				1	
	i	- 1			İ		
		1	1	1		1	
		1	1				.[
İ			{	[1
İ	- 1		1		1	1	

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001

INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM6
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

A.	CONSTRUCTION COST	\$	32168.
в.	SIOH	\$	3217.
c.	DESIGN COST	\$	1608.
D.	ENERGY CREDIT CALC (1A+1B+1C) X.	9 \$	33294.
E.	SALVAGE VALUE COST	-\$	0.

2. ENERGY SAVINGS (+) / COST (-)

ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL		UNIT COST \$/MBTU(1)				NUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS (5)	
Α.	ELECT	\$	15.50	1739.	ş	26955.	8.59		231539.
в.	DIST	\$.00	0.	\$	0.	11.28		0.
c.	RESID	\$.00	0.	\$	0.	12.01		0.
D.	NAT G	\$	3.15	4833.	\$	15224.	12.76		194258.
E.	COAL	\$.00	0.	\$	0.	10.17		0.
F.	TOTAL			6572.	\$	42178.		\$	425797.

3. NON ENERGY SAVINGS(+) / COST(-)

F. TOTAL INVESTMENT (1D-1E)

- A. ANNUAL RECURRING (+/-) \$ 0.

 (1) DISCOUNT FACTOR (TABLE A) 9.11

 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 0.
- C. TOTAL NON ENERGY DISCOUNTED SAVINGS (+) /COST (-) (3A2+3BD4) \$ 0.
- D. PROJECT NON ENERGY QUALIFICATION TEST
 - (1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 140513.
 - A IF 3D1 IS = OR > 3C GO TO ITEM 4
 - B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 - C IF 3D1B IS = > 1 GO TO ITEM 4
 - D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY
- 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 42178.
- 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 425797.
- 6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 12.79
 (IF < 1 PROJECT DOES NOT QUALIFY)

\$ 33294.

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: BHGROUP ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FT LEAVENWORTH

LCCID 1.001 REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987

DISCRETE PORTION NAME: GROUP1

PREPARED BY: CRB **ECONOMIC LIFE 15 YEARS** ANALYSIS DATE: 05-31-89

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	147021.
	B. SIOH	\$	14702.
	C. DESIGN COST	\$	7351.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	152167.
	E. SALVAGE VALUE COST `	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	152167.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUEL		JNIT COST J/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED AVINGS(5)
A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$\$\$\$\$	15.50 .00 .00 3.15 .00	5378. 0. 0. 23003. 0.	\$ \$ \$ \$ \$	83359. 0. 0. 72459. 0.	8.59 11.28 12.01 12.76 10.17	716054. 0. 0. 924583. 0.
F. TOTAL			28381.	\$	155818.		\$ 1640636.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) 0.

D. PROJECT NON ENERGY QUALIFICATION TEST

(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$ 541410.
A IF 3D1 IS = OR > 3C GO TO ITEM 4	
P IE 2D1 IS - 2C CALC SID - /2EE, 2D1//1E\-	

B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=

C IF 3D1B IS = > 1 GO TO ITEM 4 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) 155818.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) 1640636.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5/1F)=10.78 (IF < 1 PROJECT DOES NOT QUALIFY)

																	FΔ	CILI	TIF	SEN	GINI	EERI	NG \	WOR	ΚR	EQUE
				F	or us			forn	n, se	e AR 4	20-	-17 an	d DA	Pam	420-	-6; the	e pro	oonent								
	NG	D	OCUMEN.	TNU	MBE	_	-	BUIL	DINC	S/FA	CILITY	\perp		DAT	TE.		4					T101				
COD		REQ	NUME	BER	<u>د</u>	1:-		NUM			SUFFIX		YR	МС		DA		OTHE								
1 2	3 4	5 6	7 8 9	10	11 12	13	14	1516	17	18 19	20 21 2	22 2	23 24	25	26	27 21	B 29	30 31	32	33 34	35	36 37	38 3	9 40	41 4	2 43 4
Γ.,							P.	0,1	1 .	1			0.0	0	. l	٠. 5								.н.	V.Z	A,C,
XIF .		-	DCUMENT		1485	┸	_				LLITY	- [910			G/FA		<u> </u>		BUILE	LLL	ÆAC				BUILDI
TRAN		REO			Τ.	'n		NUMI		J/FAC	SUFFIX	,		UME			T	JFFIX		NUM		11 710		FIX		NUMB
	U	ID	NUMB		7	F	1					- 1							1		-	- laz			41 4	2/42/4
1 2	3 4	5 6	7 8 9	10	11 12	13	14 1	5 16	17 1	8 19	20 21 2	2 2	3 24	25 2	6 2	27 28	3 29	30 31	32	33 34	35	16 37	38 3	19 40	41 14	2 43 4
XIF							١,	1 1			, ,		1		,		١,	1 1		1	1 1	۱۸	1	,	,	1 1
EF M4 - Modify the classroom ventilator controls to allow economizer operation when the outside air is cool ehough to provide air conditioning, thus reducing the use of chilled water during moderate outdoor temperatures. ECO M5 - Modify the condenser water piping and controls to allow operation of the central chillers with a lower condenser water temperature. This will improve the efficiency of the chillers when outdoor conditions are lower than the design temperatures, thus saving electrical energy during a large portion of the operating hours. ECO M10 - Modify the cooling tower fans and controls to allow the fans to modulate according to the load with variable speed controllers. This will allow more precise control of the condenser water temperature helping to improve chiller efficiency and will also save fan horsepower because of the modulation. ECO M6 - Reprogram the building automation system and install additional sensors and components to allow the air system fans to be shut off during unoccupied periods. This will save fan horsepower when no ventilation is required. REQUESTER INFORMATION NAME ORGANIZATION TELEPHONE NO. SIGNATURE																										
											FORW				_									1		
то				- 1	REC! ACTI		MENC	ED		NVIR	ONMENT.	AL	IMPA	CT	. 8	STII	MAT	ED C	DST			FORI		FR	ОМ	
	☐ APPROVAL ☐ DISAPPROV									(I) (X)	ENVIII CONS	IDE IAT	RATI FED	TAL ONS	V	AC T	<u>-</u>	\$ \$ \$ \$		1,72	□ s	ELF-	HEL	P	FA	CILITIE
друн	APPROVING AUTHORITY								Ę	¥	COM	PLE	ETED				TAL		169	9.07	4					
											200	201/4		СТ	1001											
W DOCUMENT NUMBER										A	T	DAT		Ť	- OIV						•••			\top	·FORW	
19							ACT	ION	TAK	EN		T		1											DESIG	
										10	DA	_											MO [
1 2 3												20 21														

DA 1 AUG 78

4283

EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (C



DIN	CWO	RK REQUES	T VE	A VER	VEC						matematican or a con-				
					e of the Chief of En	gineers.									
								BU	ILDING/FAC	ILITY	_				
ОŅ				SHOP	RT JOB DESCRIPTI	ON		N	UMBER	SUFF	IX	BLANK			
37 3	8 39 40	41 42 43 44	4 45 46 4	7 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71	72 73	74 75 76	77 78 79 80			
' '	ΔiH	VAC	,c,o,n	ı,t,r,	o _l l mod	ıi ıf ıi	cation	s I	1 1 1	.1.1		1 1 1 1			
ACIL			NG/FACI		BUILDING/FA		BUILDING/FAC		BUILDIN	G/FAC	ILITY				
1	UFFIX			UFFIX	NUMBER	SUFFIX	NUMBER	SUFFIX	NUMBER		SUFFIX	BLANK			
37 3	8 39 40	41 42 43 44	45 46 4	7 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71	72 73	74 75 76	77 78 79 80			
									, , , ,		1 1				
Δ١	DESCRIBE WHAT WILL HAPPEN IF WORK IS NOT ACCOMPLISHED														
The existing economizer system does not operate efficiently and would therefore continue to waste energy. Chiller will not be at optimum operation which would continue to waste energy. Continued operation of air handling units during "off" hours would waste energy. Inadequate control of cooling tower fans wastes energy.															
	allow ntilatio														
					PERS		ALL FOR ADDITIO	NAL INFO	DRMATION						
			NAME				ORGANIZATION				I ELE	PHONE NO.			
						APPROV	ED FOR DESIGN			SOURC	E OF FL	INDS			
HOU:	SE ELP	FACILITIE	S ENGINI	EER			000	1EIMB. 1B.							
OP		D	ATE		SI	GNATUR	E	DAT	E						
UTH	ORITY	DESIGN MO D 19 20 21	A MO	DA	REMARKS							·			
		WHITE (ORIGINA	- FO	OJECT FILE COPY RWARD TO KEYPI "APPROVAL ACT	UNCH AF		GREEN	- FORWAR COMPLE APPROV	TION	OF "FOR	NCH AFTER			

12)

ENERGY CONSERVATION ANALYSIS Bell Hall

Non-ECIP Projects

PROJECT GROUP BELL HALL BLDG 111	ECO	ENERGY SAVINGS MBTU/YR	ENERGY SAVINGS \$	PROJECT COST \$	SIMPLE PAYBACK YRS	SIR
GROUP 2						
Install Solar Film	ECO-A4	1942.0	\$16,788	\$159,380	9.5	1.43
Air Curtains at Dock Doors	ECO-A5	340.0	\$1,330	\$20,319	15.3	1.21
GROUP 2 TOTALS		2282.0	\$18,118	\$179,699	9.9	1.03

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-A4

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-A4) analyzes the energy savings of installing solar shading on existing windows.

SCOPE:

The E.C.O. simulation (ECO-A4) installs solar shading on all existing windows.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- Comparison of savings for installing solar shading on existing windows which are presently unshaded.
- The heat transfer characteristics for each window was compared in order to justify the additional cost of the solar shading.

SUMMARY:

The probable project cost is \$159,380. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run are approximately 1,942 MBTU per year and \$17,000 per year.

The simple payback for this simulation is 9.5 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.43.

CONSTRUCTION COST ESTIMA	TE	DATE PREPARED SHEET 1/20/87 1							
PROJECT			L	BASIS FOR B			1	1	
BELL HALL INSTALL SOLAR S LOCATION FORT LEAVENWORTH, KS ARCHITECT/ENGINEER	SHADING	ì		x	CODE	B (PRELIMINA	N COMPLETE ARY DESIGN)	D)	
HOLLIS & MILLER / CRB					OTHER	C (FINAL DES R (SPECIFY)	ilGN)		
DRAWING NO.		ESTIM	ATOR			CHECKED B	Y		
		ANTITY		BOR		TERIAL	TOTA		
SUMMARY: ECO-A4	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	cost	,	
SOLAR SHADING ON EXISTING WINDOWS	250	EA	\$75.00	\$18,750	\$325.00	\$81,250	\$1	100.000	
								-	
SUBTOTAL:				\$18,750		\$81,250	\$1	00,000	
CONTINGENCY			10.00%	\$1,875	10.00%	\$8,125	\$	10,000	
SUBTOTAL				\$20,625		\$89,375	\$1	10,000	
COMP., TAX. SOC. SEC., INS.			13.50%	\$2,784	3.50%	\$3,128		\$5,913	
SUBTOTAL				\$23,409		\$92,503		15,913	
OVERHEAD AND PROFIT			25.00%	\$5,852	25.00%	\$23,126		28,978	
CONSTRUCTION COSTS:				\$29,262		\$115,629	\$14	14.891	

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) STUDY: FTLVEVBDL LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH REGI PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS REGION NO. 7

PI	ROJECT NO. 8	TITL	E: DACA4	1-86-C-0061	FT LEA	VENWORTH	I ESOS		
	SCAL YEAR 19 NALYSIS DATE			ISCRETE POR ECONOMI			PREPARED	BY:	CRB
1.	INVESTMEN A. CONSTRI B. SIOH C. DESIGN C D. ENERGY E. SALVAGE F. TOTAL IN	UCTI COST CRE E VAL	- DIT CALC (.UE COST	(1A+1B+1C)X.9)-1E)	ı			******	144891. 14489. 7245. 149962. 0. 149962.
2.	ENERGY SAY ANALYSIS D			T (-) AVINGS, UNIT (COST &	DISCOUNTE	D SAVINGS		
	FUEL	DISCOUNT FACTOR(4)		DISCOUNTED SAVINGS(5)					
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	***	15.50 .00 .00 3.15	864. 0. 0. 1078. 0.	\$\$\$\$\$	13392. 0. 0. 3396. 0.	11.05 16.73 17.67 19.36 13.47		147982. 0. 0. 65741. 0.
	F. TOTAL			1942.	\$	16788.		\$	213722.
3.	NON ENERG	Y SA	VINGS(+)/	COST(-)					
	A. ANNUAL I					44.05		\$	0.
			FACTOR (ED SAVINO	G/COST (3A X	3A1)	11.65		\$	0.
	C. TOTAL NO	ON EI	NERGY DIS	COUNTED SA	VINGS(+	-) /COST(-) (3	3A2+3BD4)	\$	0.
	(1) 25% M A IF 3 B IF 3 C IF 3	MAX N D1 IS D1 IS D1B	NON ENER(S = OR > 3C S < 3C CAL(IS = > 1 GO	QUALIFICATIO BY CALC (2F5 GO TO ITEM 4 SIR = (2F5+ TO ITEM 4 JECT DOES NO	X .33) 1 3D1)/1F)=	\$ 70528.		
4.	FIRST YEAR	DOL	_AR SAVIN	GS 2F3+3A+(3E	31 D/(YE.	ARS ECONO	MIC LIFE))	\$	16788.
5.	TOTAL NET	DISCO	DUNTED SA	AVINGS (2F5+3	C)			\$	213722.
6.	DISCOUNTED (IF < 1 PROJE				(5	SIR)=(5 / 1F)=	1.43		

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-A5

PURPOSE:

This Energy Conservation Opportunity simulation (ECO-A5) analyzes the energy savings of installing air curtains on existing dock doors.

SCOPE:

The E.C.O. simulation (ECO-A5) installs air curtains on the existing dock doors.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- Comparison of savings for installing air curtains on existing dock doors which presently do not have air curtains.
- The heat transfer characteristics for each door was compared in order to justify the additional cost of air curtains.

SUMMARY:

The probable project cost is \$20,319. This project cost is the construction cost plus 10% SIOH

The energy savings realized by this E.C.O. run (ECO-A1) are approximately 340 MBTU per year and \$1,400 per year.

The simple payback for this simulation is 13.2 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.12.

CONSTRUCTION COST ES	TIMATE		DATE PREP		SHEET OF				
PROJECT				BASIS FOR	STIMATE				
BELL HALL INSTALL AIR	CURTAINS								
LOCATION FORT LEAVENWORTH, K	S			X	CODE B (PRELIMINAR			
ARCHITECT/ENGINEER						FINAL DESIG	iN)		
HOLLIS & MILLER / CRB					OTHER (S	PECIFY)	274		
DRAWING NO.		ESTIMAT	OR JB			CHECKED E	GS		
	QUAN	TITY	LAI	BOR	MAT	FERIAL	TOTAL		
SUMMARY: ECO-A5	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST		
AIR CURTAINS ON EXISTING DOCK DOORS	48	LF	\$95.00	\$4,560	\$155	\$7,432	\$11,992		
MISCELANEOUS ELECTRICAL CONNECTIONS	4	EA	\$70.00	\$280	\$60	\$240	\$520		
SUBTOTAL:				\$4,840		\$7,672	\$12,512		
CONTINGENCY			10%	\$484	10%	\$767	\$1,251		
SUBTOTAL				\$5,324		\$8,440	\$13.764		
COMP., TAX. SOC. SEC., INS.			13.50%	\$719	3.50%	\$295	\$1,014		
SUBTOTAL				\$6,043		\$8,735	\$14,778		
OVERHEAD AND PROFIT			25.00%	\$1,511	25.00%	\$2,184	\$3,694		
CONSTRUCTION COSTS:				\$7,553		\$10.919	\$18,472		
				1					

LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7 PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOA5 ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 25 YEARS PREPARED BY: CRB 1. INVESTMENT A. CONSTRUCTION COST B. SIOH C. DESIGN COST D. ENERGY CREDIT CALC (1A+1B+1C) X.9															
	D. ENEF	RGY CRED					-	\$ -\$	924. 19119. 0. 19119.						
2.	ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS UNIT COST SAVINGS ANNUAL \$ DISCOUNTED														
	FUEL		NIT COST /MBTU(1)	SAVINGS MBTU/YR(2)	ANN SAV	UAL \$ INGS(3)	DISCOUNT FACTOR(4)		DISCOUNTED SAVINGS (5)						
	A. ELECT \$ 15.50														
3.	NON ENE	RGY SAV	INGS (+) /	COST(-)											
	(1)	DISCOU	JRRING (+/ NT FACTOR NTED SAVIN	(TABLE A) G/COST (3A X	3A1)		11.65	\$							
	C. TOTA	T NON E	NERGY DISC	COUNTED SAVING	S (+)	/COST(-)	(3A2+3BD4)	\$	0.						
	D. PRO (1)	25% MAX A IF S B IF S C IF S	K NON ENER 3D1 IS = 0 3D1 IS < 3 3D1B IS =	QUALIFICATION GY CALC (2F5 OR > 3C GO TO OC CALC SIR > 1 GO TO IT 1 PROJECT DOE	X .33 ITEM = (2) EM 4	4 F5+3D1)/1	\$ 7607 F)=	· .							
4.	FIRST Y	TEAR DOL	LAR SAVING	S 2F3+3A+(3B1	D/(YE	ARS ECONO									
5.	TOTAL N	ET DISCO	OUNTED SAV	rings (2F5+3C)				\$	23051.						
6.	DISCOUN	TED SAV	INGS RATIO		(SI	R) = (5 / 1)	F) = 1.21								

(IF < 1 PROJECT DOES NOT QUALIFY)

LIFE CYCLE COST ANALYSIS SUMMARY
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

STUDY: BHGROUP
LCCID 1.001

INSTALLATION & LOCATION: FT LEAVENWORTH REG

REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: GROUP2

ANALYSIS DATE: 05-31-89 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1.	INVESTMENT		
	A. CONSTRUCTION COST	\$	163363.
	B. SIOH	\$	16336.
	C. DESIGN COST	\$	8168.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	169081.
	E. SALVAGE VALUE COST	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	169081.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

	FUEL		NIT COST /MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED VINGS(5)
	A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$ \$ \$ \$ \$	15.50 .00 .00 3.15 .00	885. 0. 0. 1397. 0.	\$ \$ \$ \$ \$ \$	13718. 0. 0. 4401. 0.	8.59 11.28 12.01 12.76 10.17	117833. 0. 0. 56151. 0.
	F. TOTAL			2282.	\$	18118.		\$ 173984.
,	NON ENEDO	VCAN	INCCLATO	OCT/ \				

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 0.
(1) DISCOUNT FACTOR (TABLE A)(2) DISCOUNTED SAVING/COST (3A X 5)	9.11 A1)	\$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.

D. PROJECT NON ENERGY QUALIFICATION TEST	
(1) 25% MAX NON ENERGY CALC (2F5 X .33)	\$ 57415.
A IF 3D1 IS = OR > 3C GO TO ITEM 4	
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=	
C IF 3D1B IS = > 1 GO TO ITEM 4	
D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY	

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 18118.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 173984.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.03 (IF < 1 PROJECT DOES NOT QUALIFY)

FACILITIES ENGINEERING WORK REQUE For use of this form, see AR 420–17 and DA Pam 420–6; the proconent DOCUMENT NUMBER BUILDING/FACILITY DATE														UES									
	T W	1 0	OCUM	ENIT N	LIAAD	50	_	BUIL I	DING/EA	CILITY	For			form.	see AR 4	120-	17 aı	nd DA	Pam	420-6	; the	prooon	enta
TRANS	N N						\rightarrow	BOIL	31140717	I	-	T	T		OTHE	RFI	UND	CITA'	TION				
CODE	1 4	REC	1	MBER		اځ	TYPE	NUM	BER	SUFFI	X YF	M) 1	DA	01112		0110	•					
1 2 3	+		7 8	9 10	11	12	13	14 15 16	17 18 19	20 21 2	22 23 2	4 25	26 27	7 28	29 30 31	32	33 3	4 35 3	36 37	38 39	404	1 42 4	3 44
	T	T																					
XFA					Ш	\perp	I	900				0 0				1	_1_				H	V_1A_1C	
	GE	D	OCUME	NT N	UMB		4	BUILE	DING/FA	CILITY		BUIL	ING	/FAC	CILITY	E	BUIL	DING	DING/FACILITY			BUILE	
TRANS	HANGE	REC		RIAL		ا ز	TYPE	NUME	BER	SUFFI	x	NUM	BER .		SUFFIX		NUN	MBER SUFF			ıx	NL	JMB
	10	ID		MBER		<u>.</u>	<u>- </u>	4 15 16		1	1						22/2	125 2	6 27	20 20	40/4	1 42 4	3 44
1 2 3	4	5 6	7 8	9 110	וייו	12	13/1	4 15 16	17 18 19	120 21 2	2 23 2	4 25	6 2 /	/ 28	29 30 31	32	33 34	1353	6 37	38 39	40 4	14214	3
XIFIB	_		١.		,					1	١,	, ,			1 1	١,		1 1	1.	١.,			1
	CRIPTION AND JUSTIFICATION OF WORK TO BE ACC							OMPLIS	4ED			ומו					14						
,	call solar film on windows to reduce solar he								1		_ : _	C		1 ·	, +h	ic.	ica	ma r	ior				
	ca.	ll so	olar	film	n or) V	vın	idows t	to rea	uce so	oıar	nea	c ga	ain	. Cur	ner.	1 CT	y mo	is .	ato t	.ma	ora-	
com	pla	aint	area	, be	ecai	156	e π	any of	the	window	ws ai	e n		ope.	rabie	anc	ı 0ı ->+	ful	1 0:	anaci	+17	and	
tur	e c	days	, (ap	prox	ζ	/5`	F')	the a	air co	naiti	oning	, ls	no	C 0	perati	.ng	at	Tut.	I Co	apacı	.cy	anu	
the	he	eat i	from	sola	ar c	gaj	ın_	causes	s over	neatir	ng pr	ODT.	ems	ın	many	011	LICE	25.	١		~ T ~	ndin	~
Ins	ta:	ll a:	ir cu	rtai	ns	or	ı l	oading	g dock	to re	educe	ın	ודני	tra	tion w	נבמי	re t	truc.	KS a	are t	nit c	AUIII	y.
								ep ins	sects	and ti	ruck	exh	aust	t fi	umes c	ut	OI	the	bu:	ııaır	ig v	wite	:
the	do	ock (doors	are	e or	er	ì.																
							_		REQU	ESTER I	NFORI	MATIC	N.										
NAME	_							ORGA						LEP	HONE N	0.	SIGN	ATUP	E				
								ORGANIZATION															
										FORW	ARD F	OR A	PPRC	OVAL	L.								
то								ENDED	ENVIF	RONMENT	AL IMP	ACT	ES	MIT	ATED CO	TSC		-	K TO		FRC	M	
					ACT	rio	N		NO	YES								PER	FOR	MED			
									RI.	T ENVI	RONME	NTAL	FL	וסאר	ED \$. _					
					1		_	VAL	1 60		IDERA		W	с <u>к</u>	. \$	179	69,69	9] 11				FACIL	ITIE
					[] (DIS	APF	PROVAL	₩	□ EIS/I	EIA		w	C <u>L</u>	s				-	HELP			
									, Se	TINIT	IATED			c				: L	-	RACT		_	
APPRO	VII	NG AU	THORI	TY					29	EIS/			Ur	VFU	NDED \$				ROOF	•			D
0							СОМ	PLETE	D	\perp	TOT	AL \$	187	1.8£	ρþ								
							_			A	PPRO		CTIC	N								1 .50	2014
TI. 4S VA REO SERIAL ACCODE ID NUMBER										TE	4										DRW		
TI. 15 & REO SERIAL ME ACTION TAKE							EN	мо	DA											SIGN			
							15100	1775	4									MO 19 20	21				
1 2 3 4 5 6 7 8 9 10 11 12 13 14 A - APPROVED							ED	15 16	16 17 18					19/20	۳								
							1	DISAPPROVED 1						IOVA	AL AUTHORITY								
A																							

A 1 AUG 78 4283 EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (C

RING WO	RK REQUES	ST - XFA, XFB	, XFC e of the Chief of Er	igineers.						
						BU	ILDING/FAC	ILITY		
NC		SHO	RT JOB DESCRIPT	ION		N	UMBER	SUFFIX	. 8	LANK
37 38 39 4	041 42 43 44	45 46 47 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71	72 73 74	75 76	77 78 79 80
1 41	$H_1 V_1 A_1 C_1$	il joja di	rjejdjujcit	<u>i pın</u>				1 1		
CILITY	BUILDI	NG/FACILITY	BUILDING/FA	CILITY	BUILDING/FAC	ILITY	BUILDIN	G/FACIL	ITY	
SUFFIX			NUMBER	SUFFIX	NUMBER	SUFFIX	NUMBE		JFFIX	BLANK
37 38 39 4	0 41 42 43 44	45 46 47 48 49	50 51 52 53 54 55	56 57 58	59 60 61 62 63 64	65 66 67	68 69 70 71	72 73 74	75 76	77 78 79 80
		الما	ما ا ا ا ا							
					S NOT ACCOMPLIS					
rate te capacit are ur	is a major rate tempera- capacity and are unloading. uilding while Without solar film, office over heating will be a continual source of problems for the office personnel and the mainten- ance personnel who must respond to complaints. Solar film is a more economical solution than increasing air conditioning capacity. If air curtains are not installed on the dock doors, infil- tration will continue to be a source of wasted energy. This ECO saves approximately 2282 million BTU's per year.									
-			PER	SON TO C	ALL FOR ADDITIO	NAL INFO	RMATION			
-		NAME			ORGANIZATION				TELEP	HONĘ NO.
				10000	ED FOR BESIGN			COLIBOR	05 511	NDC
TO BE AMED FOR THE PERFORMANCE TRACT OP		S ENGINEER	S	IGNATUR	E E	DATE	DIRECT AUTOMATIC REIMB. DATE			
UTHORITY	DESIGN MO D 19 20 21	ARDED TO ESTIMATOR A MO DA 22 23 24 25 26	REMARKS							

WHITE (ORIGINAL) - PROJECT FILE COPY

FORWARD TO KEYPUNCH AFTER COMPLETION

OF "APPROVAL ACTION" BLOCK

GREEN - FORWARD TO KEYPUNCH AFTER
COMPLETION OF "FORWARD FOR
APPROVAL" BLOCK



ENERGY CONSERVATION ANALYSIS Bell Hall

ECIP Projects

LOIT TIDIECTS						
PROJECT GROUP	-m	ENERGY	ENERGY	PROJECT COST	SIMPLE PAYBACK	SIR
BELL HALL BLDG 111	ECCO	SAVINGS MBTU/YR	SAVINGS \$	\$	YRS	Sin
		IVID 1 C/ 111				
GROUP 3						
Convert Multi-Zone AHU to Variable Air Volume	ECO-M1	6015.0	\$34,842	\$352,853	10.1	1.09
Convert to Primary Secondary System	ECO-M9	2274.0	\$38,680	\$345,792	8.9	1.01
GROUP 3 TOTALS		8289.0	\$73,522	\$698,645	9.5	1.05
	1					

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M1

PURPOSE:

The purpose of this Energy Conservation Opportunity run (ECO-M1) is to analyze the energy savings that may be realized by converting the existing multi-zone ventilation units into variable air volume units.

SCOPE:

This E.C.O. simulation (ECO-M1) modifies all of the existing multi-zone ventilation units in the following areas:

- 1. Basement Office Area
- 2. Library Area
- Archive Area
- 4. Eisenhower Auditorium Area
- 5. Bookstore and Barber Shop Area

The modifications will convert the existing units from a multi-zone system to a variable air volume system. The conversion includes ductwork modifications, minor piping modifications, control modifications and the installation of a variable speed controller assembly on each air handler unit.

The new ductwork modifications will retain the existing supply and return mains, but new variable air volume control boxes and new supply air diffusers will need to be installed.

The conversion of the ventilation units will include controls for the variable air volume boxes and controls to operate the new variable speed controller unit on each supply air fan. The modifications will require testing and balancing the air systems to assure proper operation.

Reference Figure No. 1 for the floor plan of the multi-zone areas that are being modified into variable air volume systems. Reference Figures No. 2 through 4 for sketches of the ductwork layout in the Archive, Basement and Library Areas.

MODELING TECHNIQUE:

The changes made to our base model for this simulation included the following:

- The multi-zone system types were changed from MZS to VAVS.
 This modification was made to all 5 multi-zone systems
- 2. Speed control option was added under SYSTEM-FANS Keyword Command to simulate the variable frequency drives

SUMMARY:

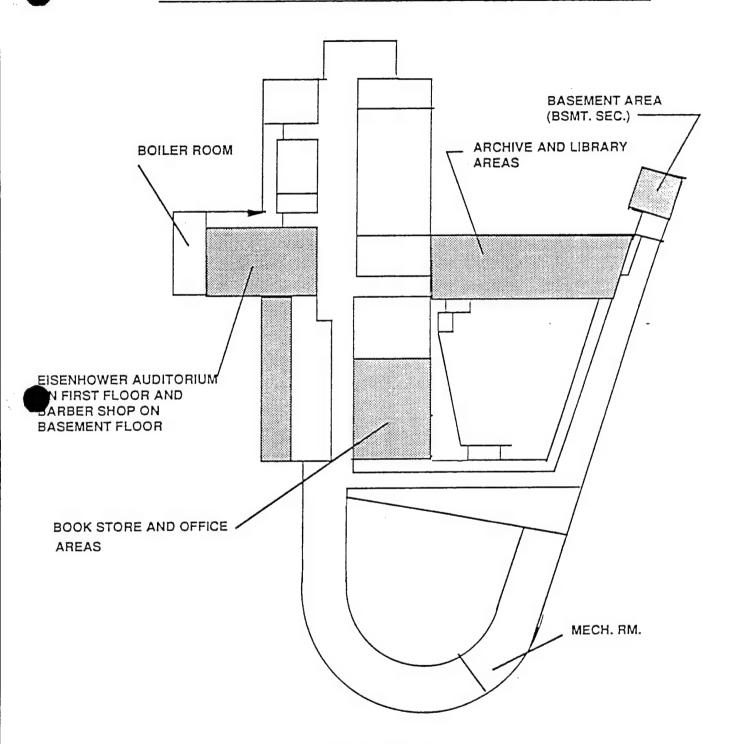
The probable project cost is \$352,853. This project cost is the construction cost plus 10% SIOH.

The energy savings realized by this E.C.O. run (ECO-M1) are approximately 6,000 MBTU per year and \$35,700 per year.

The simple payback for this simulation is 9.0 years.

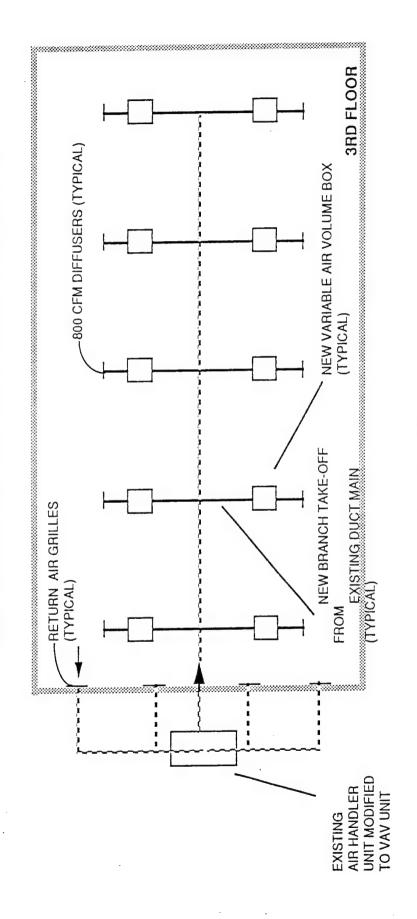
The savings to investment ratio (S.I.R.) for this simulation is 1.09.

DESCRIPTION: FLOOR PLAN OF EXISTING MULTI-ZONE AREAS



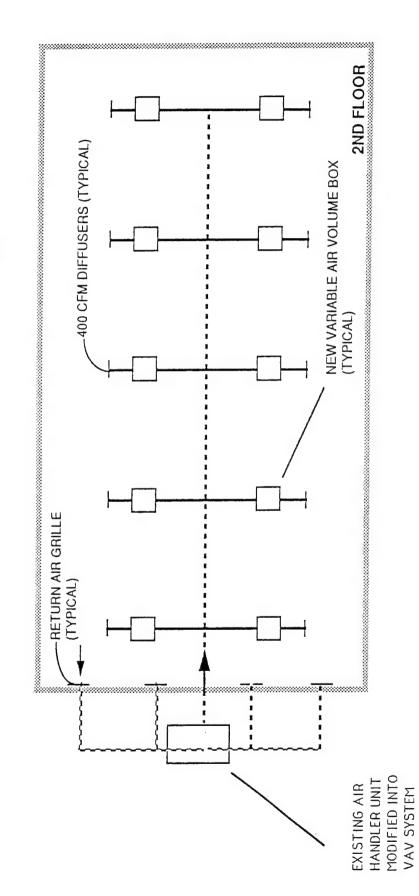
ECO-M1 FIGURE NO.1

DESCRIPTION: ARCHIVE AREA VARIABLE AIR VOLUME SYSTEM



ECO-M1 FIGURE NO. 2

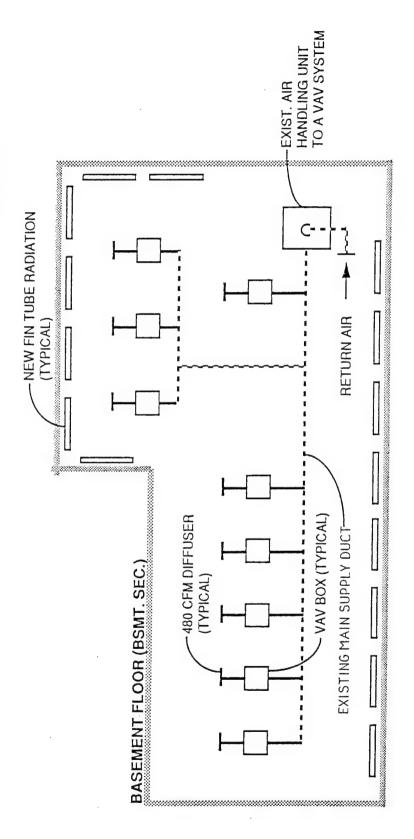
DESCRIPTION: LIBRARY VARIABLE AIR VOLUME SYSTEM



ECO-M1 FIGURE NO. 3

Page 6

DESCRIPTION: MULTIZONE TO VAV MODIFICATION OF BASEMENT AREA



ECO-M1 FIGURE NO. 4

CONSTRUCTION COST ESTIMATE			DATE PRE			SHEET OF		
BDO ISOT				16-Feb-87			5	
PROJECT BELL HALL ENERGY STUDY				BASIS FOR	ESTIMATE			
LOCATION				X			COMPLETED	
FORT LEAVENWORTH, KANS. ARCHITECT/ENGINEER	AS				CODE B (PRELIMINAI FINAL DESI	RY DESIGN)	
CLARK, RICHARDSON & BISK	UP				OTHER (S	SPECIFY)		
DECRIPTION		ESTIM	ATOR	1.0		CHECKED		
	QUA	NTITY	LAF	J.B 30R	MATI	! ERIAL	G.S. TOTAL	
SUMMARY: ECO-M1	NO.	UNIT MEAS.	PER	TOTAL	PER UNIT	TOTAL	COST	
DEMOLITION WORK TOTAL:				\$623		\$136	\$760	
NEW WORK TOTAL:				\$106,613		\$107,668	\$214,281	
SUBTOTAL:				\$107,237		\$107,804	\$215.041	
CONTINGENCY			10%	\$10,724	10%	\$10,780	\$21,504	
SUBTOTAL				\$117,960		\$118.584	\$236,545	
COMP., TAX. SOC. SEC., INS.			13.50%	\$15,925	3.50%	\$4,150	\$20.075	
SUBTOTAL				\$133,885		\$122,735	\$256,620	
OVERHEAD AND PROFIT			25.00%	\$33,471	25.00%	\$30,684	\$64,155	
CONSTRUCTION COSTS:				\$167,356		\$153,418	\$320,775	
l								
		1						

CONSTRUCTION COST ESTIMA	DATE PREPARED SHEET OF 16-Feb-87 2							
PROJECT BELL HALL ENERGY STUDY			I	16-Feb-87 2 5 BASIS FOR ESTIMATE X CODE A (NO DESIGN COMPLETE CODE B (PRELIMINARY DESIGN)				
LOCATION FORT LEAVENWORTH, KANSA								
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKU			· · · · · · · · · · · · · · · · · · ·		CODEC	FINAL DESIG		
DESCRIPTION ECO-M1(LIBRARY/ARCHIVES)		ESTIM	ATOR	J.B.	OTHER (S	CHECKED	BY G.S.	
(SUMMARY)		VTITY	LAE PER	30R	MATE		TOTAL	
	NO. UNITS	UNIT MEAS.		TOTAL	PER UNIT	TOTAL	COST	
DEMOLITION: 20" X 6" S.A. GRILLES	24	EA	\$0.85	\$20	\$0.15	\$4	\$24	
CONSTRUCTION: 20" X 8" S.A. 3RD FLR.	1000	LF	\$3.09	\$3.090	\$15.06	\$15,060	\$18,150	
VAV BOXES 3RD FLR.	18	EA	\$380.00	\$6.840	\$350.00	\$6,300	\$13,140	
14" FLEX CONNECTION	150	LF	\$2.08	\$312	\$0.75	\$113	\$425	
10" X 9" S.A. 2ND FLR.	1000	LF	\$2.09	\$2.090	\$10.22	\$10,220	\$12,310	
10" FLEX CONNECTION	150	LF	\$2.09	\$314	\$0.75	\$113	\$426	
18 VAV BOXES 2ND FLR.	18	EA	\$380.00	\$6,840	\$350.00	\$6,300	\$13,140	
800 CFM DIFFUSERS THIRD FLOOR	18	EA	\$20.00	\$360	\$64.00	\$1,152	\$1,512	
400 CFM D'FFUSERS SECOND FLOOR	18	EA	\$20.00	\$360	\$33.00	\$594	\$954	
VARIABLE SPEED CONTROLLER UNITS	2	EA	\$1,500.00	\$3,000	\$6,000.00	\$12,000	\$15,000	
SYSTEM TEST AND BALANCE	1	LS	\$520.00	\$520	\$100.00	\$100	\$620	
MOBILIZATION	1	LS	\$1,030.00	\$1,030	\$500.00	\$500	\$1.530	
ELEC. CONNECT SERVICE	1	LS	\$700.00	\$700	\$100.00	\$100	\$800	
ELEC. DISCONNECT SERVICE	1	LS	\$400.00	\$400	\$0.00	\$0	\$400	
ENG. FORM 150								

CONSTRUCTION COST ESTIMATE			DATE PRE	PARED 16-Feb-87	SHEET 3	.OF 5			
PROJECT BELL HALL ENERGY STUDY			1		BASIS FOR ESTIMATE				
LOCATION	6	 		X CODE A (NO DESIGN COMPLETED CODE B (PRELIMINARY DESIGN)					
ARCHITECT/ENGINEER					CODEC	FINAL DESIG			
CLARK, RICHARDSON & BISKU DESCRIPTION TOO MY (DATE OFFICES)	P	ESTIM	ATOR	1.0	OTHER (S	CHECKED			
ECO-M1 (BMT OFFICES)		VIIIY		J.B. BOR		RIAL	G.S. TOTAL		
(SUMMARY)	NO. UNITS	UNIT MEAS.	PER UNIT	TOTAL	PER UNIT	TOTAL	COST		
DEMOLITION: 480 CFM DIFFUSERS	8	EA	\$0.85	\$7	\$0.15	\$1	\$8		
CONSTRUCTION: VAV BOXES	9	EA	\$380.00	\$3,420	\$350.00	\$3,150	\$6,570		
480 CFM DIFFUSERS		EA	\$25.00	\$225	\$33.00	\$297	\$522		
14" FLEX CONNECTION	40	LF	\$2.08	\$83	\$0.75	\$30	\$113		
4.0 MBH FIN/TUBE RADIATORS W/COVERS	100	LF	\$6.00	\$600	\$11.75	\$1,175	\$1,775		
VARIABLE SPEED CONTROLLER	1	EA	\$1,500.00	\$1,500	\$6,000.00	\$6,000	\$7,500		
3" HOT WATER PIPE FOR RADIATOR	250	LF	\$10.09	\$2.523	\$8.22	\$2,055	\$4,578		
3/4" PIPE FOR RADIATOR	880	LF	\$5.05	\$4,444	\$3.28	\$2,886	\$7,330		
3/4" ISOLATION VALVES	24	EA	\$13.73	\$330	\$12.33	\$296	\$625		
STATS FOR RADIATORS	12	EA	\$35.00	\$420	\$50.00	\$600	\$1,020		
FIN TUBE HEATER CONTROLS	1	LS	\$25.00	\$25	\$25.00	\$25	\$50		
CEILING REMOVAL/REPLACEMENT	12000	SF	\$2.75	\$33,000	\$0.45	\$5,400	\$38,400		
SYSTEM TEST AND BALANCE	1	LS	\$3,500.00	\$3,500	\$400.00	\$400	\$3,900		
MOBILIZATION	1	LS	\$3,500.00	\$3,500	\$400.00	\$400	\$3,900		
ENC FORM 150									

				24252		LOUISET	05		
CONSTRUCTION COST ES	TIMATE		DATE PRE	REPARED SHEET OF 16-Feb-87 4 5					
PROJECT			<u> </u>	BASIS FOR					
BELL HALL ENERGY STUD	Υ								
LOCATION	NOAG			X			COMPLETED)		
FORT LEAVENWORTH, KA	NSAS					PRELIMINAR FINAL DESIG			
CLARK, RICHARDSON & B	ISKUP				OTHER (S	PECIFY)			
DECRIPTION		ESTIM	IATOR			CHECKED			
ECO-M1 (AUDITORIUM)	T CUM	VTITY	LAE	J.B.	MATE	DIAL	G.S. TOTAL		
(SUMMAI		UNIT	PER	TOTAL	PER	TOTAL	COST		
	UNITS	1			UNIT				
DEMOLITION:					22.25		222		
2000 CFM DIFUSSERS	15	EA	\$1.85	\$28	\$0.25	\$4	\$32		
900 CFM DIFFUSERS	10	EA	\$1.85	\$19	\$0.25	\$3	\$21		
DUCTWORK REPAIR	50	SF	\$10.00	\$500	\$2.00	\$100	\$600		
CONSTRUCTION: VAV BOXES ON MAIN LEVEL	9	EA	\$380.00	\$3,420	\$350.00	\$3,150	\$6.570		
VAV BOXES ON LOWER LEVEL	. 6	EA	\$380.00	\$2,280	\$350.00	\$2,100	\$4,380		
VAV BOXES ON UPPER LEVEL	10	EA	\$380.00	\$3,800	\$350.00	\$3,500	\$7,300		
VAV BOXES ON OUT EN EEVEE	·	-/-	3000.00	00,000	0000,00				
2000 CFM DIFFUSERS	15	EA	\$25.00	\$375	\$135.00	\$2.025	\$2,400		
1000 CFM DIFFUSERS	10	ΕA	\$25.00	\$250	\$75.00	\$750	\$1,000		
1000 CFM DIFF CSERS			923.00	0200	0,0.00	0.00			
20" DIA. FLEX DUCT	150	LF	\$2.09	\$314	\$1.50	\$225	\$539		
24" V 17' S A DUICTMODE	250	1 =	\$4.96	\$1,240	\$24.21	\$6,053	\$7.293		
24" X 17' S.A. DUCTWORK	250	LF	34.90	31,240	324.21	30,000	\$7.230		
VARIABLE SPEED CONTROLLER UNIT	1	EA	\$1,500.00	\$1,500	\$6,000.00	\$6,000	\$7.500		
CONTROL MODIFICATIONS		LS	\$1,000.00	\$1.000	\$250.00	\$250	\$1.250		
CONTROL MODIFICATIONS		LS	31,000.00	31.000	9230.00	3230	31.230		
SYSTEM TEST AND BALANCE	1	LS	\$2,500.00	\$2,500	\$300.00	\$300	\$2,800		
MODILIZATION	1	LS	\$2,500.00	\$2.500	\$500.00	\$500	\$3,000		
MOBILIZATION		LS	32,300.00	\$2,300	3300.00	3300	55,555		
ELEC. DISCONNNECT SERVICE	1	LS	\$400.00	\$400	\$0.00	\$0	\$400		
ELEC CONNECT SERVICE	4	LS	\$700.00	\$700	\$100.00	\$100	\$800		
ELEC. CONNECT SERVICE		LO	3700.00	3700	3100.00	\$100	2000		
ENG EODM 150									

CONSTRUCTION COST ESTIMA		DATE PRE	ATE PREPARED SHEET OF				
PDO (FOT				16-Feb-87		5	5
PROJECT BELL HALL ENERGY STUDY				BASIS FOR	ESTIMATE		-
LOCATION FORT LEAVENWORTH, KANSA	s			×			COMPLETED
ARCHITECT/ENGINEER CLARK, RICHARDSON & BISKU						FINAL DESIG	
DECRIPTION	•	ESTIM	IATOR			CHECKED	
ECO-M1 (STORE/BARBER)	CUA	NTITY	LAF	J.B. 30R	MATE	L FRIAL	G.S.
(SUMMARY)	NO.	UNIT MEAS.	PER	TOTAL	PER UNIT	TOTAL	COST
DEMOLITION: 24" X 18" S.A. DUCTWORK	1	LS	\$50.00	\$50	\$25.00	\$25	\$75
CONSTRUCTION: VAV BOX - 2800 CFM	1	EA	\$380.00	\$380	\$350.00	\$350	\$730
VAV BOX - 400 CFM	. 1	EA	\$380.00	\$380	\$350.00	\$350	\$730
DUCTWORK MODIFICATIONS	1	LS	\$500.00	\$500	\$80.00	\$80	\$580
AHU MODIFICATIONS	1	LS	\$250.00	\$250	\$120.00	\$120	\$370
VARIABLE SPEED CONTORLLER	1	EA	\$1,500.00	\$1.500	\$6.000.00	\$6,000	\$7,500
ELEC. DISCONNECT	1	LS	\$400.00	\$400	\$0.00	\$0	\$400
ELEC. CONNECT	1	LS	\$700.00	\$700	\$100.00	\$100	\$800
CONTROLS	1	LS	\$1,000.00	\$1,000	\$250.00	\$250	\$1,250
SYSTEM TEST AND BALANCE	1	LS	\$800.00	\$800	\$100.00	\$100	\$900
MOBILIZATION	1	LS	\$1,000.00	\$1,000	\$100.00	\$100	\$1,100
							!
			·				

LIFE CYCLE COST ANALYSIS SUMMARY - STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001

INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM1
ANALYSIS DATE: 07-21-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1.	INVESTMENT
----	------------

A.	CONSTRUCTION COST	\$	320775.
	SIOH	\$	32078.
c.	DESIGN COST	\$	16039.
D.	ENERGY CREDIT CALC (1A+1B+1C) X.9	\$	332003.
E.	SALVAGE VALUE COST	-\$	0.
F.	TOTAL INVESTMENT (1D-1E)	\$	332003.

2. ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	EL.	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NUAL \$ VINGS(3)	DISCOUNT FACTOR(4)	DISCOUNTED SAVINGS (5)
Α.	ELECT	\$ 15.50	1287.	\$	19949.	8.59	171358.
в.	DIST	\$.00	0.	ş	0.	11.28	0.
c.	RESID	s .00	0.	\$	0.	12.01	0.
D.	NAT G	\$ 3.15	4728.	\$	14893.	12.76	190037.
E.	COAL	\$.00	0.	\$	0.	10.17	0.
F.	TOTAL		6015.	\$	34842.		s 361395.

3. NON ENERGY SAVINGS(+) / COST(-)

A.	ANNUAL RECURRING (+/-)	\$ 0.
	(1) DISCOUNT FACTOR (TABLE A) 9.11	
	(2) DISCOUNTED SAVING/COST (3A X 3A1)	\$ 0.

- C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.
- D. PROJECT NON ENERGY QUALIFICATION TEST
 - (1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 119260.
 - A IF 3D1 IS = OR > 3C GO TO ITEM 4
 - B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 - C IF 3D1B IS = > 1 GO TO ITEM 4
 - D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY
- 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 34842.
- 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 361395.
- 6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.09 (IF < 1 PROJECT DOES NOT QUALIFY)

FORT LEAVENWORTH - BELL HALL BUILDING 111

ENERGY CONSERVATION OPPORTUNITY: ECO-M9

PURPOSE:

The purpose of this Energy Conservation Opportunity run (ECO-M9) is to analyze the energy savings that may be realized by converting the existing primary pumping system into a primary-secondary type pumping system. The conversion will retain the existing two-pipe heating and cooling distribution network in the facility.

SCOPE:

ECO-M9

This E.C.O. simulation (ECO-M9) converts the existing two-pipe heating and cooling pumping system into a primary-secondary pumping system. The conversion from the existing system to a primary-secondary pumping system will require the following:

- 1. New primary circulation pumps
- Modifications to the existing boiler room chilled water piping and boiler piping loops
- 3. Pipe modifications to connect the existing radiation pumps into the secondary loop
- 4. New variable speed controller units for each circulation pump
- 5. New electrical services for the pumps and variable speed controllers

The construction work involved in this simulation may disrupt the heating and cooling capabilities of the boiler room facility during the construction phases.

The installation of the primary and secondary pumping system will require testing and balancing of the hydronic system in the boiler room as well as the distribution network. Reference Figures No. 1 and 2 for the layout of the boiler room equipment and piping.

MODELING TECHNIQUES:

The changes made to our base model for this simulation include the following:

- 1. Since PC-DOE is not capable of calculating pumping energy for primary/secondary pumping (Re: Section I, Modeling Techniques), we calculated the average flow required for cooling and heating during one full year. We then calculated what the average head pressure would be for the existing pumps. This information was then used to redefine the pump criteria entered in the input file (Re: Volume II, Section I) on line No.'s 2,349 through 2,354. The following pump criteria was changed:
 - A. CIRC-DESIGN-T-DROP=9.8
 - B. CCIRC-HEAD=29'
 - C. HEAT-DESIGN-T-DROP=12.5
 - D. HEAT-HEAD=32'

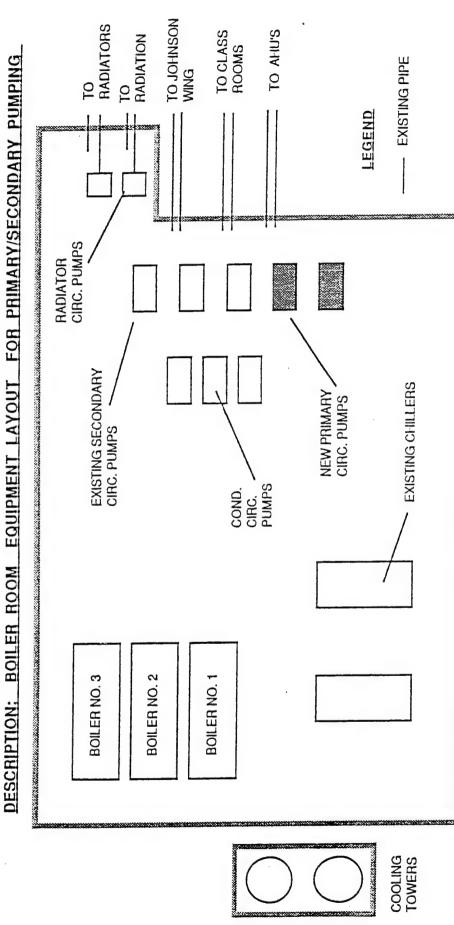
SUMMARY:

The probable project cost is \$345,792. This project cost is the construction cost plus 10% SIOH

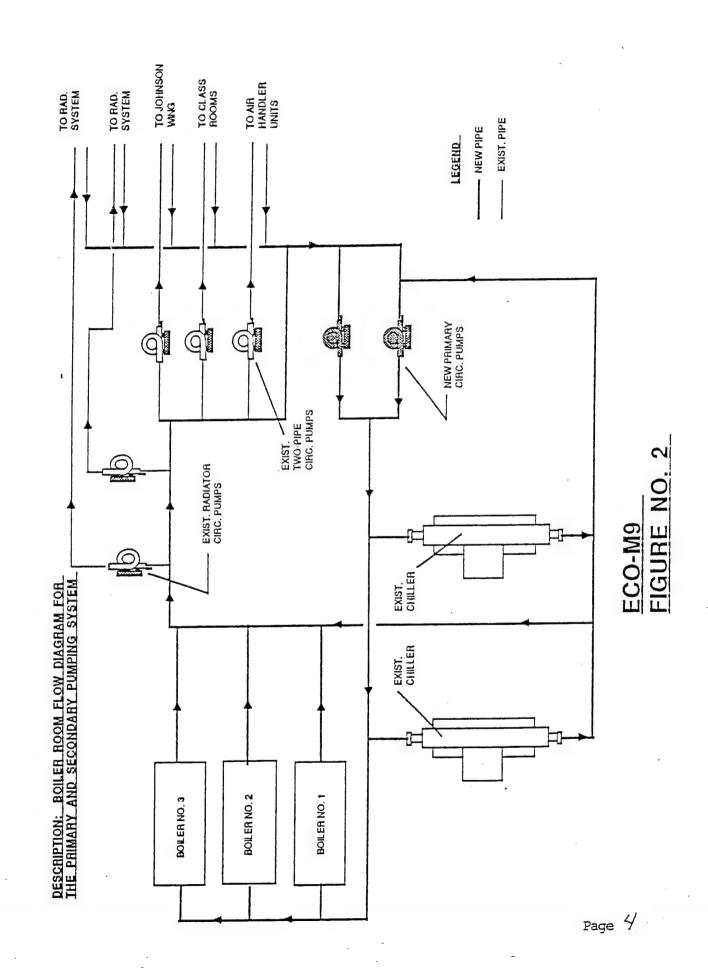
The energy savings realized by this E.C.O. run (ECO-M9) are approximately 2,280 MBTU per year and \$38,700 per year.

The simple payback for this simulation is 8.1 years.

The savings to investment ratio (S.I.R.) for this simulation is 1.01.



ECO-M9 FIGURE NO. 1



CONSTRUCTION COST ESTIMATE			DATE PRE	PARED		SHEET OF		
				16-Feb-87		1	3	
PROJECT BELL HALL ENERGY STUDY				BASIS FOR	RESTIMATE			
LOCATION				Х	CODE A	(NO DESIGN	COMPLETE	
FORT LEAVENWORTH, KANSAS					CODEB	(PRELIMINAL	RY DESIGN)	
ARCHITECT/ENGINEER						(FINAL DESI	GN)	
CLARK, RICHARDSON & BISKUP		T=0=:::	.=		OTHER (SPECIFY)		
DECRIPTION		ESTIM	AIOH	J.B.		CHECKED	G.S.	
	QUA	NTITY	LA	BOR	MA	TERIAL	TOTAL	
SUMMARY: ECO-M9	NO.	UNIT	PER	TOTAL	PER	TOTAL	COST	
	UNITS	MEAS.	UNIT		UNIT			
DEMOLITION WORK TOTAL:				\$6,950		\$2,276	50.005	
DEMOCITION WORK TOTAL.		 		30,930		32,270	\$9,225	
NEW WORK TOTAL:				\$87,882		\$114,622	\$202,504	
SUBTOTAL:				\$94,832		\$116,898	\$211,729	
CONTINGENCY			10.00%	\$9,483	10.00%	\$11,690	\$21,173	
SUBTOTAL				\$104,315		\$128,587	\$232,902	
COMP., TAX. SOC. SEC., INS.			13.50%	\$14,082	3.50%	\$4,501	\$18,583	
SUBTOTAL				\$118,397		\$133,088	\$251,485	
OVERHEAD AND PROFIT			25.00%	\$20.500	25 00%	\$22.070	\$60.071	
OVERHEAD AND PROPE			25.00 %	\$29,599	25.00%	\$33,272	\$62.871	
CONSTRUCTION COSTS:							\$314,356	
·								
·								
·								

CONSTRUCTION COST ESTIMATE			DATE PREF			SHEET	OF	
PROJECT				16-Feb-87 BASIS FOR ESTIMATE			3	
BELL HALL ENERGY STUDY LOCATION	X CODE A					(NO DESIGN COMPLETED		
FORT LEAVENWORTH, KANSAS ARCHITECT/ENGINEER					CODE B (PRELIMINARY DESIGN) CODE C (FINAL DESIGN)			
CLARK, RICHARDSON & BISKUP DESCRIPTION ESTIMATOR					OTHER (SPECIFY) [CHECKED BY			
ECO-M9 (PRIMARY/SECONDARY)				J.B.		G.S.		
(SUMMARY)	NO.	VTITU	PER	TOTAL	PER	TERIAL TOTAL	TOTAL COST	
DEMOLITION:		MEAS.		2050	UNIT	050	4700	
REMOVE EXIST. CIRCULATION PUMPS		EEA	\$325.00	\$650	\$25.00	\$50	\$700	
REMOVE EXIST. ELEC. SERVICE TO PUMPS	2	EA	\$140.00	\$280	\$50.00	\$100	\$380	
REMOVE 12" PIPE	180	LF	\$4.65	\$837	\$1.50	\$270	\$1,107	
REMOVE 8" PIPE	700	LF	\$4.65	\$3,255	\$1.50	\$1,050	\$4,305	
REMOVE 4" PIPE	200	LF	\$3.75	\$750	\$1.15	\$230	\$980	
REMOVE 6" PIPE	250	LF	\$3.75	\$938	\$1.15	\$288	\$1,225	
REMOVE EXIST. CONTROL VALVES	4	EA	\$10.00	\$40	\$12.00	\$48	\$88	
REMOVE EXISTING ISOLATION VALVES	20	EA	\$10.00	\$200	\$12.00	\$240	\$440	
CONSTRUCTION: INSTALL 1000 GPM PRIMARY PUMPS	2	EA	\$305.00	\$610	\$2,000.00	\$4.000	\$4,610	
MODIFY EXIST. 350 GPM PUMPS	3	EA	\$205.00	\$615	\$250.00	\$750	\$1,365	
PRIMARY PUMP SPEED CONTROLLER	2	EA	\$1,500.00	\$3.000	\$6,000.00	\$12,000	\$15.000	
SECONDARY PUMP SPEED CONTROLLER	3	EA	\$1.500.00	\$4,500	\$6,000.00	\$18,000	\$22,500	
RADIATOR PUMP SPEED CONTROLLER	2	EA	\$1,500.00	\$3,000	\$6,000.00	\$12,000	\$15,000	
10" CHECK VALVES TO PRIMARY PUMPS	2	EA	\$250.00	\$500	\$3,475.00	\$6,950	\$7,450	
10" PRIMARY ISOLATION VALVES	4	EA	\$120.00	\$480	\$33.00	\$132	\$612	
6" SECONDARY ISOLATION VALVES	6	EA	\$90.00	\$540	\$23.00	\$138	\$678	
8" ISOLATION VALVES-CHILLER/BOILER	8	EA	\$110.00	\$880	\$27.00	\$216	\$1,096	
4" ISOLATION VALVES-CHILLER/BOILER	4	EA	\$77.00	\$308	\$22.00	\$88	\$396	
PRIMARY/SECONDARY PUMP CONTROLS	1	LS	\$1,200.00	\$1,200	\$3,000.00	\$3,000	\$4,200	
12" PIPE	200	LF	\$35.00	\$7,000	\$55.00	\$11,000	\$18,000	
8" PIPE	200	LF	\$22.00	\$4,400	\$32.00	\$6,400	\$10.800	
6" PIPE	150	LF	\$8.50	\$1,275	\$8.00	\$1,200	\$2,475	
4* PIPE	150	LF	\$12.00	\$1,800	\$12.00	\$1,800	\$3,600	
PUMP FLEX. CONNECTION	14	EA	\$35.00	\$490	\$345.00	\$4,830	\$5,320	
NEW TO EXIST, UTILITY CONNECTIONS	10	EA	\$223.00	\$2,230	\$172.00	\$1,720	\$3,950	
8" CONTROL VALVES ENG. FORM 150	4	EA	\$800.00	\$3.200	\$200.00	\$800	\$4,000	

	CONSTRUCTION COST ESTIMATE					SHEET 3	OF 3	
	ROJECT				16-Feb-87 BASIS FOR ESTIMATE		13	3
)	BELL HALL ENERGY STUDY DOCATION				X CODE A (NO DESIGN COMPLETED)			
	FORT LEAVENWORTH, KANSAS RCHITECT/ENGINEER			CODE B (PRELIMINARY DE CODE C (FINAL DESIGN)				
	CLARK, RICHARDSON & BISKUP DESCRIPTION	LARK, RICHARDSON & BISKUP				OTHER (SPECIFY) CHECKED BY	
	ECO-M9 (PRIMARY/SECONDARY)	0114		J.B.			TERIAL	F.S.
	(SUMMARY)	NO. UNITS	NTITY UNIT MEAS.	PER UNIT	BOR TOTAL	PER UNIT	TOTAL	COST
	STRAINERS	7	EA	\$210.00	\$1,470	\$500.00	\$3,500	\$4,970
	TEMP. GAUGES	24	EA	\$7.00	\$168	\$50.00	\$1,200	\$1,368
	PRESS. GAUGES	24	EA	\$6.00	\$144	\$20.00	\$480	\$624
	SECONDARY PUMP CHECK VALVES	5	EA	\$220.00	\$1,100	\$2,200.00	\$11,000	\$12,100
	4" TO 6" PIPE FITTINGS	40	EA	\$145.00	\$5,800	\$127.00	\$5,080	\$10,880
	8" TO 12" PIPE FITTINGS	20	EA	\$225.00	\$4,500	\$304.00	\$6,080	\$10,580
	EQUIPMENT MOBILIZATION	1	LS	\$1,300.00	\$1,300	\$430.00	\$430	\$1,730
	PIPING MOBILIZATION	1	LS	\$2,500.00	\$2,500	\$1,000.00	\$1,000	\$3,500
	SYSTEM TEST AND BALANCE	1	LS	\$3,000.00	\$3,000	\$500.00	\$500	\$3,500
	CONNECT PRIMARY PUMP	2	EA	\$305.00	\$610	\$80.00	\$160	\$770
	CONNECT SECONDARY PUMP	3	EA	\$300.00	\$900	\$55.00	\$165	\$1,065
	·							
5	NG FORM 150							

ENG. FORM 1AVC-59

150

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: FTLVBDLM ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001

INSTALLATION & LOCATION: FT LEAVENWORTH, KANSAS - REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS.

FISCAL YEAR 1987 DISCRETE PORTION NAME: ECOM9

ANALYSIS DATE: 07-22-87 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1. INVESTMENT

Α.	CONSTRUCTION COST	\$	314356.
B.	SIOH	\$	31436.
c.	DESIGN COST	\$	15718.
D.	ENERGY CREDIT CALC (1A+1B+1C) X.9	\$	325359.
E.	SALVAGE VALUE COST	-\$	0.
F.	TOTAL INVESTMENT (1D-1E)	\$	325359.

2. ENERGY SAVINGS (+) / COST (-)
ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS

FUE	EL	UNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)	NUAL \$ VINGS(3)	DISCOUNT FACTOR (4)	DISCOUNTED SAVINGS (5)
Α.	ELECT	\$ 15.50	2552.	\$ 39556.	8.59	339786.
В.	DIST	\$.00	0.	\$ 0.	11.28	0.
c.	RESID	\$.00	0.	\$ 0.	12.01	0.
D.	NAT G	\$ 3.15	-278.	\$ -876.	12.76	-11174.
E.	COAL	\$.00	0.	\$ 0.	10.17	0.
F.	TOTAL		2274.	\$ 38680.		\$ 328612.

- 3. NON ENERGY SAVINGS(+) / COST(-)
 - A. ANNUAL RECURRING (+/-) \$ 0 (1) DISCOUNT FACTOR (TABLE A) 9.11 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 0
 - C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.
 - D. PROJECT NON ENERGY QUALIFICATION TEST
 - (1) 25% MAX NON ENERGY CALC (2F5 X .33) \$ 108442.
 - A IF 3D1 IS = OR > 3C GO TO ITEM 4
 - B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)=
 - C IF 3D1B IS = > 1 GO TO ITEM 4
 - D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY
- 4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 38680.
- 5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 328612
- 6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.01 (IF < 1 PROJECT DOES NOT QUALIFY)

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: BHGROUP

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.001 INSTALLATION & LOCATION: FT LEAVENWORTH REGION NO. 7

PROJECT NO. & TITLE: DACA41-86-C-0061 FT LEAVENWORTH ESOS

FISCAL YEAR 1987 DISCRETE PORTION NAME: GROUP3

ANALYSIS DATE: 05-31-89 ECONOMIC LIFE 15 YEARS PREPARED BY: CRB

1.	INVESTMENT A. CONSTRUCTION COST	\$	635131.
	B. SIOH	\$	63513.
	C. DESIGN COST	\$	31757.
	D. ENERGY CREDIT CALC (1A+1B+1C)X.9	\$	657361.
	E. SALVAGE VALUE COST `	-\$	0.
	F. TOTAL INVESTMENT (1D-1E)	\$	657361.
2.	ENERGY SAVINGS (+) / COST (-) ANALYSIS DATE ANNUAL SAVINGS, UNIT COST & DISCOUNTED SAVINGS		

FUEL		JNIT COST \$/MBTU(1)	SAVINGS MBTU/YR(2)		NNUAL \$ AVINGS(3)	DISCOUNT FACTOR(4)	SCOUNTED VINGS(5)
A. ELECT B. DIST C. RESID D. NAT G E. COAL	\$\$\$\$\$	15.50 .00 .00 3.15 .00	3840. 0. 0. 4450. 0.	\$ \$ \$ \$ \$	59520. 0. 0. 14018. 0.	8.59 11.28 12.01 12.76 10.17	511277. 0. 0. 178863. 0.
F. TOTAL			8290.	\$	73538.		\$ 690140.

3. NON ENERGY SAVINGS(+) / COST(-)

A. ANNUAL RECURRING (+/-)		\$ 0.
(1) DISCOUNT FACTOR (TABLE A)	9.11	
(2) DISCOUNTED SAVING/COST (3A X 3A1)		\$ 0.

C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+) /COST(-) (3A2+3BD4) \$ 0.

• •	 •
D. PROJECT NON ENERGY QUALIFICATION TEST (1) 25% MAX NON ENERGY CALC (2F5 X .33) A IF 3D1 IS = OR > 3C GO TO ITEM 4	\$ 227746.
B IF 3D1 IS < 3C CALC SIR = (2F5+3D1)/1F)= C IF 3D1B IS = > 1 GO TO ITEM 4 D IF 3D1B IS < 1 PROJECT DOES NOT QUALIFY	

4. FIRST YEAR DOLLAR SAVINGS 2F3+3A+(3B1D/(YEARS ECONOMIC LIFE)) \$ 73538.

5. TOTAL NET DISCOUNTED SAVINGS (2F5+3C) \$ 690140.

6. DISCOUNTED SAVINGS RATIO (SIR)=(5 / 1F)= 1.05 (IF < 1 PROJECT DOES NOT QUALIFY)

	_				-									-			
									For	use of th	is form	FACILIT	TIES EN	GINEERI d DA Pam	NG WOF	RK REC	UES
	GE	DO	DCUMENT N	UMBE	R	BUILDI	NG/FA	CILITY		DATE							
TRANS CODE		REQ	SERIAL NUMBER		TYPE	NUMBE	R	SUFFI	X YF	мо	DA	ОТНЕ	R FUND (CITATION			
1 2 3	4	5 6	7 8 9 10	11 1	2 13	14 15 16 1	7 18 19	20 21 2	2 23 2	4 25 26	27 28	29 30 31	32 33 34	35 36 37	38 39 40	41 42 4	43 44
XIFIA						P101011	173-25		9 10	0 16	5 0				ı Al ^H	V _I A (2
	S F	DC	CUMENT N	UMBE	R	BUILDI	NG/FA	CILITY		BUILDI	NG/FA	CILITY	BUILD	ING/FACI	LITY	BUI	ILDIN
TRANS CODE	CHANG	REQ	NUMBER			NUMBE		SUFFI		NUMBE		SUFFIX	NUM		SUFFIX		UMBE
1 2 3	4	5 6	7 8 9 10	11 1:	2 13	14 15 16 17	18 19	20 21 2	2 23 2	4 25 26	27 28	29 30 31	32 33 34	35 36 37	38 39 40	41 42 4	13 44
X F B			D INSTIFICA	TION	LOF	WORK TO B	LA	OMPLISH	1ED		لمل			ملا			
unit warm by m to a wate is c	vert existing multi-zone handling units to variable air volume units. Multizone units cool all of the air and then heat part of the air back up to allow mixing of warm and cold air at each room to control space temperature. VAV systems save energy by maintaining a constant cold air temperature and varying the amount of air supplied to a room to control space temperature. Convert the existing chilled water and hot water pumping system to a variable flow primary-secondary system. The existing system is constant flow requiring the same amount of pumping energy regardless of the air conditioning or heating load. A variable flow system can save energy by reducing the flow when it is not required, saving pump horsepower.																
								FORW	ARD F	OR APP	ROVA	L					
то				ACT	_	MENDED	NO '				ESTIN	IATED CO		WORK TO PERFORM	MED	MOF	
				1 =		PROVAL	⊠ ⊠	© EIS/E		FIONS	WC L	_ s	698,64	∏ IN-HO □ SELF- □ CONTE	HELP	FACIL	TIE:
APPRO	VIN	IG AU	THORITY				Ø	EIS/I	IATED EIA PLETE		WC UNFU TOT	NDED \$.	31,75 730,40	TROOP			D/
								A	PPROV	AL AC	TION						
(36	000	CUMENT NU						DA	TE						·F(ORW,
CODE	CHANGE	REQ	SERIAL	FΥ	YPE	ACTIO	N TAKI	EN	мо	DA							SIGN
	4	1D 5 6	7 8 9 10			14			15 16	17 18						19 20	0 21
1 2 3	-	210	, 1913110	- 1 2	-3	A - AP	PROVE	D	1.51.8	77,10	SIGI	NATURE	OF APPRO	OVAL AU	THORITY		+
XIF IC	2		1111			D DIS	SAPPRO	OVED	1							11	1_1

DA 1 AUG 78 4283

EDITION OF 1 FEB 78 WILL BE USED UNTIL EXHAUSTED.

WHITE (C



ORK REQUE	EST — >	(FA, XFE	, XF	C the Chief of En	igineers.												
									BU	ILDI	NG/FA	CIL	ITY	\Box	_		
•		SHO	RT J	DB DESCRIPT	ION				N	UMB	ER	s	UFF	IX	В	LAN	ıĸ
40 41 42 43	44 45 46	47 48 49	50 5	51 52 53 54 55	56 57 58	59 60 61	52 63 64	65	66 67	68	9 70 7	71 7:	2 73	74 75	76	77 7	8 79 80
. ц тл л. С	. m. o	.a.d€	i .c		ne.											1	
HVAC	ING/FA			BUILDING/FA		BUILD	NG/FAC	111	ΓY	В	UILDI		FAC	ILITY			
-IX NUM		SUFFIX		NUMBER	SUFFIX	NUME	ER	su	FFIX		NUMB	E R		SUFF	IX	8	LANK
40 41 42 43 4	45 46	47 48 49	50 5	1 52 53 54 55	56 57 58	59 60 61	62 63 64	65	66 67	68 6	9 70 7	1 72	2 73	74 75	76 7	7 78	79 80
	DESC	RIBE WHA	L AT W	I I I I A	F WORK I	S NOT AC	L LA	HEC	<u> </u>		11	1	اما			1	11
g of energy upplied d hot g system air ing the	energy upplied If the existing chilled and hot water pumping system is not converted to variable flow, the system will continue to waste energy and extra capacity may have to be added to allow for future computer loads. A variable flow system can shift																
	-			PER	SON TO C	ALL FOR A	DDITIO	NAL	INFO	ORM	ATION			-			
	NAME					ORGANIZA	TION							TE	LEPI	HON	Ę NO.
-			г		APPROV	ED FOR D	ESIGN				Т	SO	URC	E OF	FUN	IDS	
FACILITI	ES ENGI	NEER] DI	REC	T MATI	C RE	IMB	
C	ATE		-	SI	GNATUR	E			DAT	E		JFL	IONU	ED RE	IMB	•	
DESIG	DA MO	MATOR	R	IEMARKS							1						
WHITE PINK	ORIGIA	- FO	RWA	T FILE COPY ARD TO KEYP PROVAL ACT	UNCH AFT		LETION	G	REEN	(FORW. COMPL APPRO	ETI	ON) F "F	ORW		FTER D FOR

PROJECT DEVELOPMENT BROCHURE

facility

BELL HALL FORT LEAVENWORTH, KANSAS

project coordinator for using service

functional requirements summary, PDB-1

DA FORM 5020-1-R, Feb 82

TM 5-800-3

installation: FORT LEAVENWORT	Н
project: HVAC MODIFICATIONS	(BELL HALL)
project number	program year
point of contact:	
	date
title	phone
dfae	autovon
	date
title	phone
engineer district	autovon
	date
title	phone
	autovon
other (A-E) name	date
title	phone
	autovon
reviewed by:	
installation facility engineer name	date
title	phone
	autovon
approved by: macom engineer	
name	date
title	phone
	autovon

project development brochure, PDB-1

DA FORM 5020-R, Feb 82

TM 5-800-3

OBJECTIVE

This project will provide energy savings by increasing the efficiency of the Bell Hall HVAC systems.

CURRENT CONDITIONS

Currently the existing multi-zone air handling units function as constant volume units that supply the same amount of air at varying temperatures. This requires the fans to operate at full capacity all of the time. The existing constant volume chilled water pumping system supplies the same amount of chilled water throughout the building, regardless of the cooling requirement. The temperatures are maintained by mixing return chilled water with the supply chilled water. This requires that the pumps operate at design capacity all of the time.

PROOSED MODIFICATIONS

This project would convert 5 existing multizone air handling units to allow operation as variable air volume units and convert the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

The multizone units converted to VAV would serve the basement office area, library area, archive area, Eisenhower Auditorium area and the bookstore and barbershop area. The conversion would consist of a variable speed controller on the fan motors, control modifications, and installation of variable volume supply boxes in the individual areas.

The conversion of the constant volume pumping system would include, new primary circulation pumps, modifications to the chilled water and heating water piping loops, new variable speed controllers for the secondary circulation pumps and DDC control modifications.

The electrical savings is 8289 MBTU's per year and the savings to investment ratio is 1.05.

functional requirements summary, PDB-1

DA FORM 5020-2-R, Feb 82

TM 5-800-3

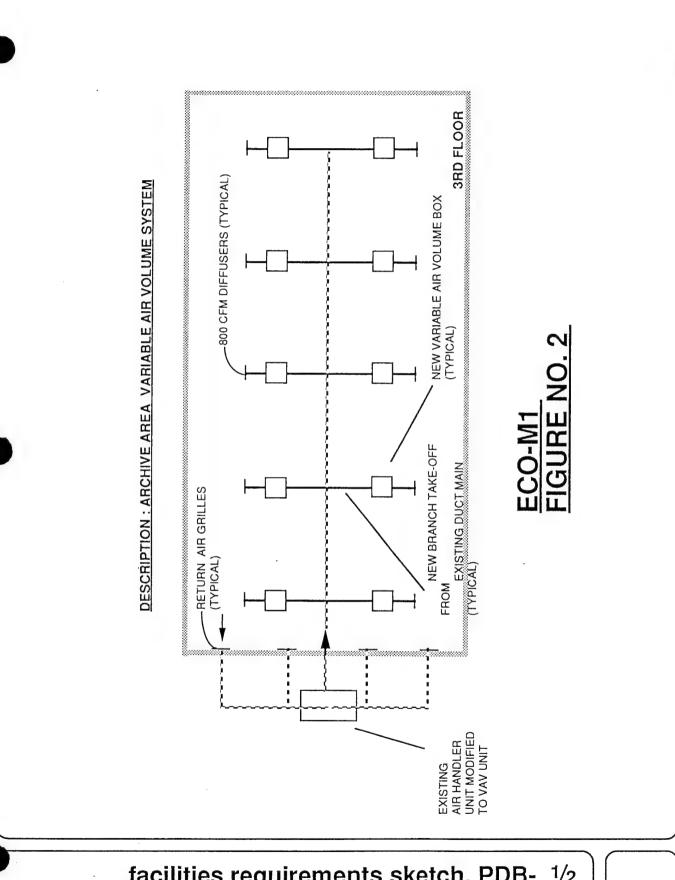
DESCRIPTION: FLOOR PLAN OF EXISTING MULTI-ZONE AREAS **BASEMENT AREA** (BSMT. SEC.) ARCHIVE AND LIBRARY BOILER ROOM AREAS **EISENHOWER AUDITORIUM** ON FIRST FLOOR AND BARBER SHOP ON **BASEMENT FLOOR BOOK STORE AND OFFICE AREAS** MECH. RM. ECO-M1

FIGURE NO.1

facilities requirements sketch, PDB- 1/2

DA FORM 5022-R, Feb 82

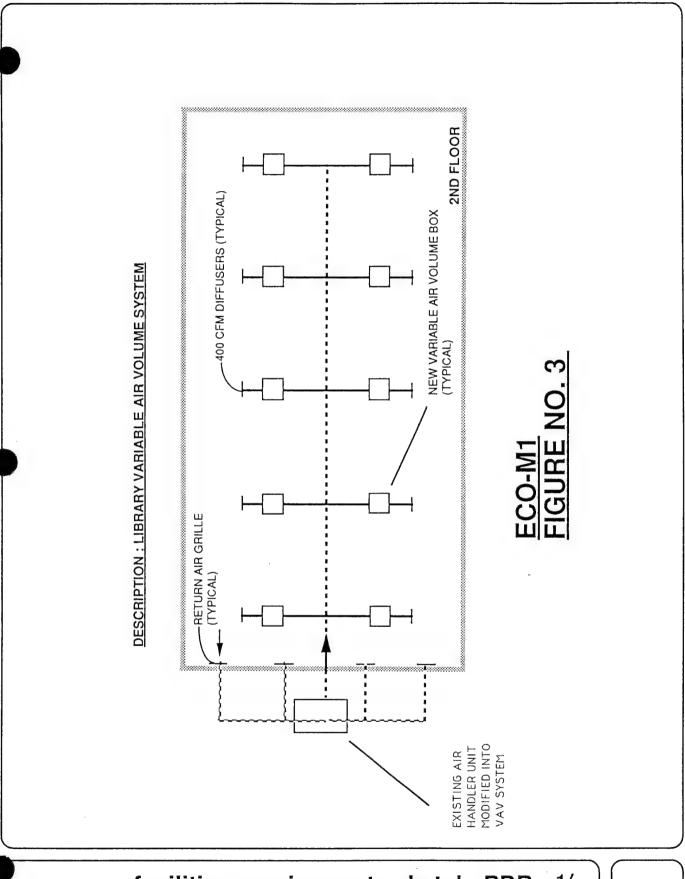
TM 5-800-3



facilities requirements sketch, PDB-

DA FORM 5022-R, Feb 82

TM 5-800-3

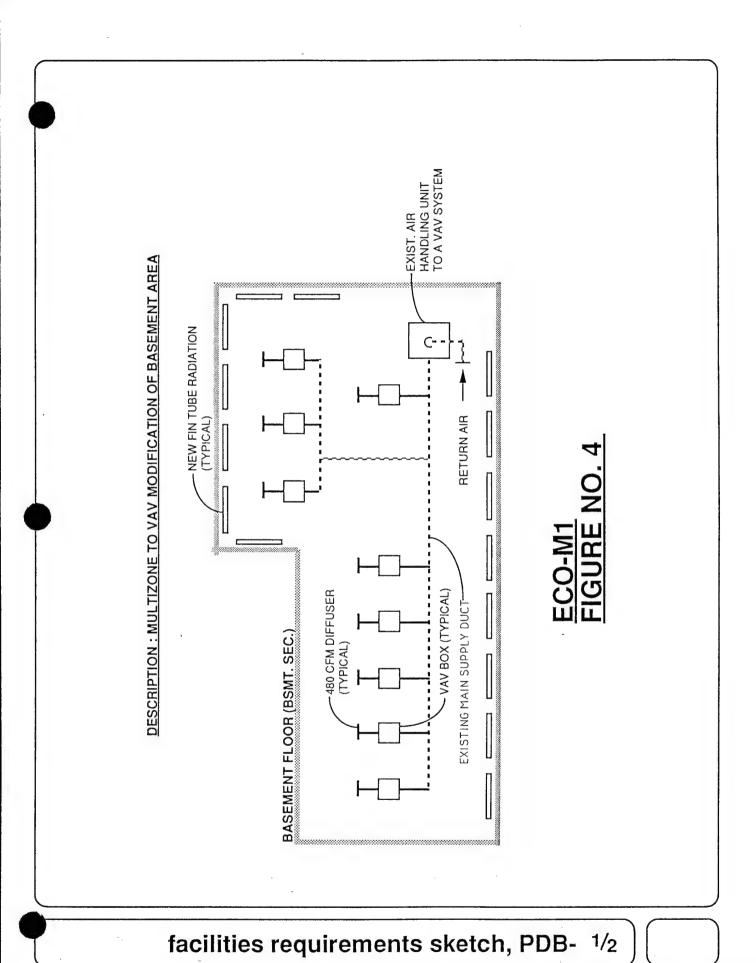


facilities requirements sketch, PDB- 1/2

DA FORM 5022-R, Feb 82

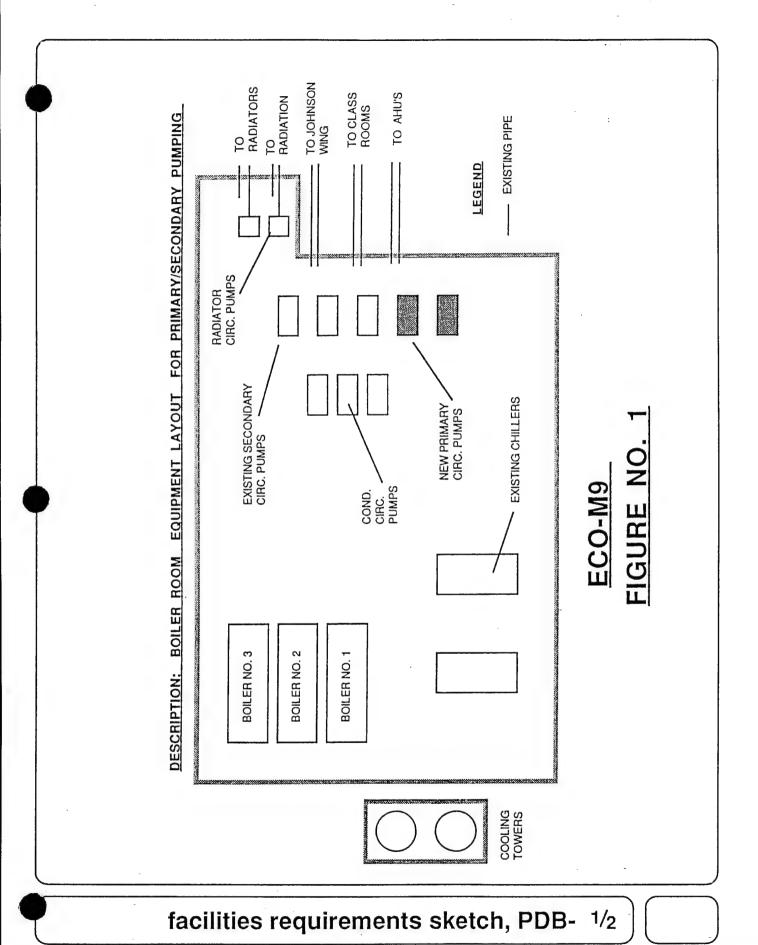
TM 5-800-3

- A-21



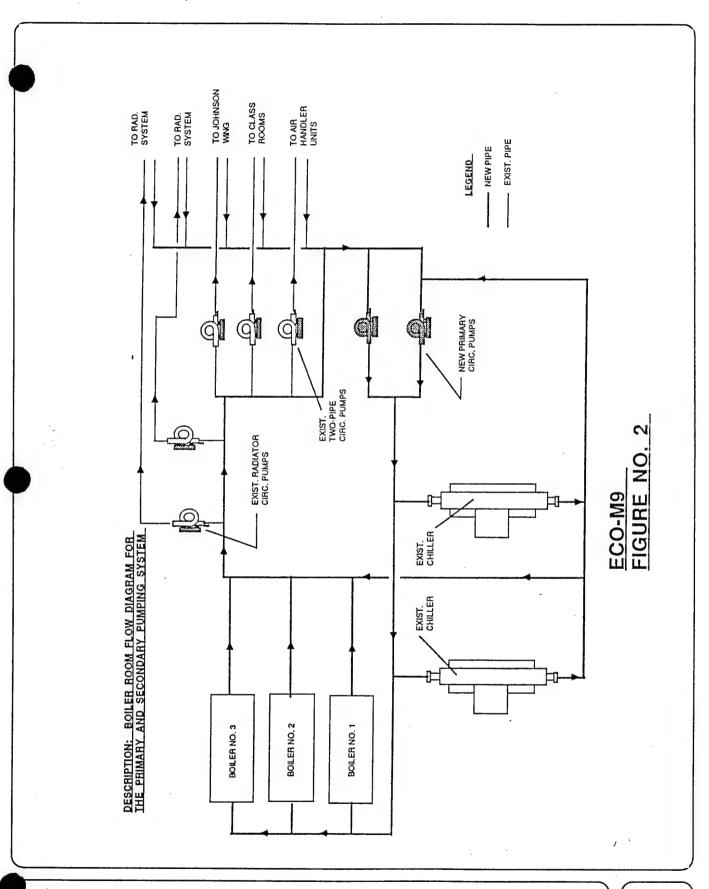
DA FORM 5022-R, Feb 82

TM 5-800-3



DA FORM 5022-R, Feb 82

TM 5-800-3



facilities requirements sketch, PDB- 1/2

DA FORM 5022-R, Feb 82

TM 5-800-3

A. SPECIAL CONSIDERATIONS

	A. SPECIAL CONSIDERATIONS)	red or equire	* mined	rent led
	ITEM		Required or Not Require	To Be * Determined	Comment Attached
A-1	Cost estimates for each primary and supporting facility		R	D	
A-2	Telecommunications system coordination with USACC & authorization for exemptions		NR		
A-3	Coordination with state and local governmental requirements (blind vendors, medical facilities, construction and operating permints, clearinghouse coordination, etc.)		NR		
A-4	Assignment of airspace		NR		
A-5	Economic analysis of alternatives	11	R	••••••	***************************************
A-6	Approval for new starts		NR	*************	**************
A-7	International balance of payments (IBOP) coordination with U.S. European command and NATO-overseas cost estimates and comparables (include rate of exchange used)		NR		
A-8	Impact on historic places-on site survey by authorized acheologist and coordination with state historic preservation officer and advisory council on historic preservation		NR		
A-9	Exceptions to established criteria		NR		
A-10	Coordination with various staff agencies (Provost Marshall-physical security, etc.)		NR		
A-11	Identification of related support projects (so projects can be coordinated)		R	В	
A-12	Required completion date		NR		
	Other Special Considerations (List and number items)				

REQUIRED OR NOT REQUIRED - Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED - Information needed by not currently available. Enter code for information souce.

COMMENT ATTACHED - Significant information summarized or explained and attached.

DOCUMENT ATTACHED - Significant information is in an existing document which is attached.

* BY WHOM (Check and insert appropriate letter)

- A DFAE
- B Using Service
- C Construction Service
- D Designer
- E Other (Check Comments Attached and explain)

documentation checklist

B. SITE DEVELOPMENT ITEM Consultation with the District Office to determine and evaluate flood plain hazards NR Preparation, submission, and/or approval of new B-2 NR (A) General Site Plan NR (B) Annotated General Site Plan (C) Sketch Site Plan NR (D) Facilities Requirements Sketch NR Preparation of HR. (A) Site Survey (B) Subsoil information NR B - 4 Approval by Department of Defense Explosive Safety Board (DDESB) for Safety Site Plan Other Site Development Considerations (List and number items)

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A - DFAE

B - Using Service

C - Construction Service

D - Designer

E - Other (Check Comments Attached and

documentation checklist

DA FORM 5023-B-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

	ITEM
C-1	Reconciliation with troop housing programs and requirements
C-2	Evaluation of existing facilities (including degree of utilization)
C-3	Approval for removal and relocation of existing useable facilities
C-4	Evaluation of off-post community facilities
C-5	Storage and maintenance facilities (including nuclear weapons)
C-6	Coordination hospitals, medical and dental facilities with Surgeon General
C-7	Coordination of aviation facilities with FAA
C-8	Coordination air traffic control and navigational aids with USACC
C-9	Tabulation of types and numbers of aircraft
C-10	Evaluation of laboratory, research and development, and technical maintenance facilities
C-11	Coordination chapels with Chief of Chaplains
C-12	Review food service facilities by USATSA
C-13	Automated data processing system or equipment approvals—cost analysis when ADP and/or communication centers not co-located with related facilities
C-14	Coordination postal facilities with U.S. Postal Service Regional Director
C-15	Laundry and dry cleaning facilities coordination with ASD(I&L)
C-16	Tenant facilities coordination with installation where sited
C-17	Facilities for or exposed to explosions, toxic chemicals, or ammunition—review by DDESB (See also Item B-4)
C-18	Analysis of deficiencies
C-19	Consideration of alternatives
C-20	Determination whether occupants will Include physically handicapped or disabled persons
C-21	As-build drawings for alterations or additions
C-22	Availability of Standard Design or site adaptable designs
	Other Architectural & Structural (List and number items)

	-	T	
Required or Not Required	To Be * Determined	Comment Attached	Document Attached
HUNDER NEW NEW NEW NEW NEW NEW NEW NEW NEW NEW			
NR			
NR			
NR			
NR			
NR			
NR.			
NR_			
NK			
NO			
NR			
NR			
NR			
NR NR NR R			<u> </u>
K	-A		
NR			
NR R R R R R R R R R R R R R R R R R R			V
R			V
NR			
.R			
NR			
		1	
		1	
		1	
1	1	1	1

REQUIRED OR NOT REQUIRED — Not relevant or no information to cominunicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is Irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A - DFAE

B - Using Service

C - Construction Service

D - Designer

E - Other (Check Comments Attached and explain)

documentation checklist

DA FORM 5023-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

	ITEM	Required	ot Req	To Be Determi	Commer Attached	Docume Attacher
	11 E IVI			FΩ	Ū∢	٥٩
D-1	Fuel considerations and cost comparison analysis	14	R.			
D-2	Energy requirements appraisal (ERA)	THE PER	<u> </u>			
D-3	Conformance with DOD Energy Reduction requirements	P		0		V
D-4	Evaluation of existing and/or proposed utility systems	N	2			
	Other Mechanical and Utility Systems (List and number items)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A DFAE
- B Using Service
- C Construction Service
- D Designe
- E Other (Check Comments Attached and explain)

documentation checklist

DA FORM 5023-D-R, Feb 82

E. ENVIRONMENTAL CONSIDERATIONS

	ITEM	Required Not Req	To Be Determir	Commen Attachec	Documer
E-1	Environmental impact assessment	MR			
E-2	EIA conclusions require Environmental Impact Statement	NR			
E-3	Determination of health, environmental or related hazards. Assistance to determine existence of any health, environmental or related hazard may be requested from Aberdeen Proving Ground, MD 21010, the Office of the Surgeon General, Attn: DASG-HCH (Army Environmental Hygiene Agency)	HR			
E-4	Air/water pollution permit, coordination with agencies and compliance with standards at Federal, state and local level	NR			
E-5	Corrective measures associated with Environmental Impact Statements or assessment—list separately and evaluate.	NR			
	Other environmental considerations (list and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project.

Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A - DFAE

B - Using Service

C - Construction Service

D — Designer

E — Other (Check Comments Attached and explain)

documentation checklist

DA FORM 5023-E-R, Feb 82

TM 5-800-3 C-13

A. SPECIAL CONSIDERATIONS

	ITEM		Required Not Req	To Be Determir	Commen	Docume Attached
A-1	Factors of risk, restriction or unusual circumstance expected to increase costs beyond applicable area averages		RRR	D		
A-2	Construction phasing requirements		R	D		
A-3	Functional support equipment (mechanical, electrical, structural, and security) to be built in	.	R	0		
A-4	Equipment in place and justification		NR			
A-5	Other equipment and furniture (O&MA, OPA) and costs		MR			
A-6	Special studies and tests (hazards analyses, compatibility testing, new technology testing, etc.)		NR			
A-7	Type of construction (permanent, temporary, semi-permanent)		R	D		
A-8	Government furnished equipment (quantities, procurement time, availability and special handling and storage requirements). Funds used for procurement.		NR			
	Other special considerations (list and number items)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project.

Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A DFAE
- B Using Service
- C Construction Service
- D Designer
- E Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-A-R, Feb 82

B. SITE DEVELOPMENT

	ITEM	Required Not Requi	To Be Determine	Comment Attached	Document Attached
B-1	Construction restrictions or guidelines pertaining to				
(A)	site access and preferred construction routes	NR			
(B)	Airfield clearance, explosive storage, working hours, safety, etc.	NR.			
(c)	Facilities and/or functions or adjoining areas (structures, materials, impact)	HR			
8-2	Real estate actions (acquisition, disposal, lease, right-of-way)	HR			
B-3	Demolition/relocation required (data)				
(A)	Special considerations due to explosives/radioactivity/ chemical contamination/asbestos emissions/toxic gases	NR			
(B)	Restrictions on disposal of demolished/relocated material including hazardous waste	NR.			
B-4	Pavement types and requirements (including traffic surveys and MTMC coordination)	HR			
B-5	Landscape considerations				
(A)	Protection of existing vegetation	NR			
(B)	Stockpile topsoil	NR			
	Other Site Development (List and number items)				

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A DFAE
- B Using Service
- $\mathsf{C}\,-\mathsf{Construction}\,\mathsf{Service}$
- D Designer
- E Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-B-R, Feb 82

C. ARCHITECTURAL & STRUCTURAL

	ITEM	0	Not Rec	To Be Determi	Comme	Docume
C-1	Vibration-producing equipment requiring isolation	1	B.	D		
C-2	Seismic zone and other design load criteria (typhoon, hurricane, earthquake loads, high or low loss potential)		R	D		
C-3	Protective shelter evaluation and resistant design criteria (conventional/nuclear blast and radiation, chemical/biological)	11	IR			
C-4	Unusual foundation requirements (pier, pile, caisson, deep foundations, mat, special treatment, permafrost areas, soil bearing)		1R			
C-5	Designation and strength of units to be accommodated	N	R			
C-6	Requirements and data for special design projects		18_			
C-7	Unusual floor and roof loads (safes, equipment)	N	IR			
C-8	Security features (arms rooms, vaults, interior secure areas)	1	JR			
	Other Architectural & Structural (List and number items)					

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED — Significant information summarized or explained and attached.

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A DFA
- B Using Service
- C Construction Service
- D Designer
- E Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-C-R, Feb 82

D. MECHANICAL, ELECTRICAL, & UTILITY SYSTEMS

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

COMMENT ATTACHED - Significant information summarized or explained

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

A - DFAE

B - Using Service

C - Construction Service

D - Designer

E - Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-D-R, Feb 82

E. ENVIRONMENTAL CONSIDERATIONS To Be * Determined ITEM Waste water treatment, air quality, and solid waste disposal criteria Other Environmental Considerations (List and number items)

REQUIRED OR NOT REQUIRED — Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.

TO BE DETERMINED — Information needed but not currently available. Enter code for information source.

 ${\bf COMMENT\ A\ TTACHED\ -\ Significant\ information\ summarized\ or\ explained\ and\ attached.}$

DOCUMENT ATTACHED — Significant information is in an existing document which is attached.

*BY WHOM (Check and insert appropriate letter)

- A DFAE
- B Using Service
- C Construction Service
- D Designer
- E Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-E-R, Feb 82

Required or Not Required F. FIRE PROTECTION To Be * Determined Comment Attached ITEM Special fire protection systems or features (detection and suppression equipment, hazards, etc.) NR Other Fire Protection Considerations (List and number items)

- REQUIRED OR NOT REQUIRED Not relevant or no information to communicate. Enter "R" if item is relevant and is required for this project. Enter "NR" if item is irrelevant and is not required for this project.
- TO BE DETERMINED Information needed but not currently available. Enter code for information source.
- COMMENT ATTACHED Significant information summarized or explained and attached.
- DOCUMENT ATTACHED Significant information is in an existing document which is attached.
- *BY WHOM (Check and insert appropriate letter)
 - A DFAE
 - B Using Service
 - C Construction Service
 - D Designer
 - E Other (Check Comments Attached and explain)

technical data checklist

DA FORM 5024-F-R, Feb 82

FORM 1391

4 COMPONIENT							
1. COMPONENT ARMY					2. DATE 5-Jun-90		
3. INSTALLATION AND LOCATION 4. PROJECT TITLE FORT LEAVENWORTH, KANSAS HVAC Modifications				(Bell Hall)		
5. PROGRAM ELE	MENT	6. CATEGORY CODE 80000	CODE 7. PROJECT NUMBER 8. PROJEC			T COST \$700,000	
		<u> </u>	9. COST ESTIMATES		1		
		ITEM	o. oor commerce	U/M	QUANTITY	UNIT COST	COST (\$000)
Steam and/or C			_				
Convert CHW s	system to I	Primary/Secondary Pumpir	ng	LS	1	\$345,792	\$346
Air Conditioning Convert Milti-Zo		o VAV	_	LS	1	\$353,853	\$354
			Facility Subtotal			\$699,645	\$700

10. DESCRIPTION OF PROPOSED CONSTRUCTION

This project would convert 5 existing multi-zone air handling units to allow operation as variable air volume units and convert the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

The multi-zone units converted to VAV would serve the basement office area, library area, archive area, Eisenhower Auditorium area and the bookstore and barbershop area. The conversion would consist of a variable speed controller on the fan motors, control modifications, and installation of variable volume supply boxes in the individual areas.

The conversion of the constant volume pumping system would include, new primary circulation pumps, modifications to the chilled water and heating water piping loops, new variable speed controllers for the secondary circulation pumps and DDC control modifications.

The electrical savings is 8289 MBTU's per year and the the savings to investment ratio is 1.05.

DD FORM 1391 1 DEC 76

PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)

1. COMPONENT ARMY	FY 1990 MILITARY CONSTRUCTION PROJECT DATA		2. DATE Jun 5, 1990
3. INSTALLATION AN FORT LEAVENY	ID LOCATION VORTH, KANSAS		
4. PROJECT TITLE HVAC Modificat	ions (Bell Hall)	5. PROJEC	TNUMBER

11.J REMARKS:

This project will provide energy savings by increasing the efficiency of the Bell Hall HVAC systems.

11.K RELATED PROJECTS:

No other project are dependent upon this project.

11.L PROJECT:

Conversion of the existing multi-zone air handling units to allow operation as variable air volume units and conversion of the existing constant volume chilled water pumping system to a variable flow primary/secondary pumping system.

11.M REQUIREMENT

a. This project will aid in reducing the consumption of electricity to help meet national energy reduction goals which is the reason for the ESOS and ECIP programs.

b. All buildings will be in active use during the amortization period.

11.N CURRENT SITUATION:

Results from the field survey indicate that the existing systems are currently meeting the requirements cond of the facility. However, this project improves the efficiency of the HVAC systems by allowing them to modulate and follow the changes in the air conditioning loads. The current systems are constant volume and run at full air flow and water flow capacity all of the time, which uses more fan and pump horsepower than the variable flow systems.

11.0 IMPACT IF NOT PROVIDED:

If this project is not approved, the electrical energy consumption will remain the same and will not contribute to the energy saving goals of the DOD.

1. COMPONENT ARMY	FY 1990 MILITARY CONSTRUCTION PROJECT DATA	2. DATE 5-Jun-90
3. INSTALLATION A FORT LEAVENV	ND LOCATION VORTH, KANSAS	
4. PROJECT TITLE HVAC Modificat	ions (Beil Hali)	5. PROJECT NUMBER

D1. GENERAL:

This project is required as part of the DOD plan to reduce the energy consumption per gross square foot of building area. This project improves the efficiency of the air conditioning systems at Bell Hall, located at Fort Leavenworth. The primary mission of Ft. Leavenworth is the Military War College. This building is the primary center for this function. This project does not involve the arrival of a new weapons system.

D2. ACCOMMODATIONS NOW IN USE:

Building 111, Bell Hall.

D3. ANALYSIS OF DEFICIENCY:

Currently the existing multi-zone air handling units function as constant volume units that supply the same amount of air at varying temperatures. This requires the fans to operate at full capacity all of the time. The existing constant volume chilled water pumping system supplies the same amount of chilled water throughout the building, regardless of the cooling requirement. The temperatures are maintained by mixing return chilled water with the supply chilled water. This requires that the pumps operate at design capacity all of the time.

D4. CONSIDERATION OF ALTERNATIVES:

The alternatives to reduce fan and pump horsepower involve reducing air and water flows or modifying existing duct and piping supply & return systems to reduce pressure drops. Reducing the air and water flows was unacceptable because the system would not meet peak load requirements. Modifying the existing duct and piping alternatives were rejected because of high capitol costs and excessive downtime required for construction, and the minimal benefit.

D5. CRITERIA FOR PROPOSED CONSTRUCTION:

The proposed project will conform with all applicable Federal and US Army regulations.

D6. PROGRAM FOR RELATED FURNISHINGS AND EQUIPMENT:

Not applicable.

D7. DISPOSAL OF PRESENT ASSETS:

Not applicable.

D8. SURVIVAL MEASURES:

Not applicable.

D9. SUMMARY OF ENVIRONMENTAL CONSEQUENCES:

This project has no environmental consequences, other than a reduction in energy use, which translates to a positive impact.

DD

FORM 1 DEC 76

1391C

PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)

1. COMPONENT
ARMY
FY 1990 MILITARY CONSTRUCTION PROJECT DATA

2. DATE
5-Jun-90

3. INSTALLATION AND LOCATION
FORT LEAVENWORTH, KANSAS

4. PROJECT TITLE

15. PROJECT NUMBER

D10. EVALUATION OF FLOOD HAZARDS:

Not applicable.

D11. ECONOMIC JUSTIFICATION:

See attached LCCID printouts.

HVAC Modifications (Bell Hall)

D12. UTILITY AND COMMUNICATIONS SUPPORT:

No new utilities are required for support of this project.

D13.PROTECTION OF HISTORIC PLACES AND ARCHAEOLOGICAL SITES:

The proposed project will not alter building construction or appearance.

D14. PROJECT DEVELOPMENT BROCHURE:

A Project Development Brochure has been prepared.

D15. ENERGY REQUIREMENTS:

A summary of the results of the full energy study follows .:

Annua:

3840 MBTU's per year electricity

4450 MBTU's per year natural gas

Total:

\$690,140

Initial:

\$657,361

Savin:

1.05

D16. PROVISIONS FOR THE HANDICAPPED:

Not applicable.

D17. REAL PROPERTY MAINTENANCE ACTIVITY (RPMA):

The completion of this project will not have an impact on property maintenance.

D18. COMMERCIAL ACTIVITIES (CA) ANALYSIS:

Not applicable. This project does not constitute a new start or expansion.

DD

FORM 1 DEC 76 1391C

PREVIOUS EDITIONS MAY BE USED INTERNALLY UNTIL EXHAUSTED FOR OFFICIAL USE ONLY (WHEN DATA IS ENTERED)